OUTER HYLEBOS 1998 MONITORING REPORT

August 10, 1999

PREPARED FOR:
The Puyallup Tribe of Indians
2002 East 28th Street
Tacoma, WA 98404

Prepared by:
Applied Environmental Services, Inc.
1550 Woodridge Drive SE
Port Orchard, WA 98366

Applied Environmental Services, Inc.
1345 West 9th Avenue, Suite 203
Anchorage, AK 99501

APPLIED
ENVIRONMENTAL
SERVICES, INC.

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AUG 12 1999
Environmental Cleanup Office

Wednesday, August 11, 1999

U.S. Environmental Protection Agency Region 10
M.S. ECL-111
1200 Sixth Avenue
Seattle, WA 98101

Attention: Alison Hiltner

Subject: Final Outer Hylebos Fourth Monitoring Report 1998

Dear Alison,

Enclosed is a copy of the Outer Hylebos 1998 Monitoring Report. Bill Sullivan has asked me to mail you a copy directly. If you have any questions please feel free to call (360) 769-8400.

Sincerely,

Alison O'Sullivan
Environmental Scientist

ATO:ao

enclosure

1550 Woodridge Dr. SE
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PREFACE

This report has been prepared by Applied Environmental Services, Inc. (AES) following the described methods and information available to the best of our knowledge at the time of the work. The information presented in this report reflects AES's best professional opinion regarding the subject property. The applicant is advised to contact all appropriate regulatory agencies (local, state, and federal) prior to design or construction of any development to obtain necessary permits and approvals. Wetland boundaries, classifications and discussions are based on our understanding of the local, state, and federal regulations, and site conditions at the time of our work. The final wetland boundary determination and wetland classification is to be made or verified by the appropriate jurisdictional agency. Within the defined scope of our contract, schedule, and budget, our services have been executed in accordance with standards acceptable in this profession at the time this report was prepared. No warranty, declared or implied, should be understood.

Lisa Stephens

Lisa B. Stephens, PWS
Environmental Scientist, President

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INTRODUCTION

The Port of Tacoma filled a portion of the Lincoln Avenue Ditch in cooperation with the Puyallup Tribe of Indians. The fill consisted of 0.08 acres of intertidal area located within the City of Tacoma, along the north shore of the Blair Waterway in Tacoma (Figure 1). The mitigation plan for the fill of the ditch involved the creation and enhancement of intertidal and freshwater wetlands and upland habitat at a site near the outlet of the Hylebos Waterway. The restoration/enhancement project is fully described in the Lincoln Ditch Mitigation Plan dated June 18, 1993. Details for the construction of the project are presented in the Project Manual for the Outer Hylebos Mitigation Plan (AES, December 1994).

The performance of the mitigation at Outer Hylebos is currently being monitored. Monitoring began when the restoration planting was completed in the fall of 1995. Annual assessments of vegetation, fauna, topography and hydrology are conducted for years one, two and three when plant communities and hydric soil are becoming established, as suggested by Kentula et al. (1993).

This report summarizes the data collected during the 1998-monitoring year. Since this report covers year four, comparison information regarding vegetation, hydrology, topography, and wildlife has not been included. If additional comparison data is required, please reference the "As-Built" and First Monitoring Report (AES 1995), the Outer Hylebos 2nd Monitoring Report (AES 1996) or the Outer Hylebos 3rd Monitoring Report (AES 1997) as needed.

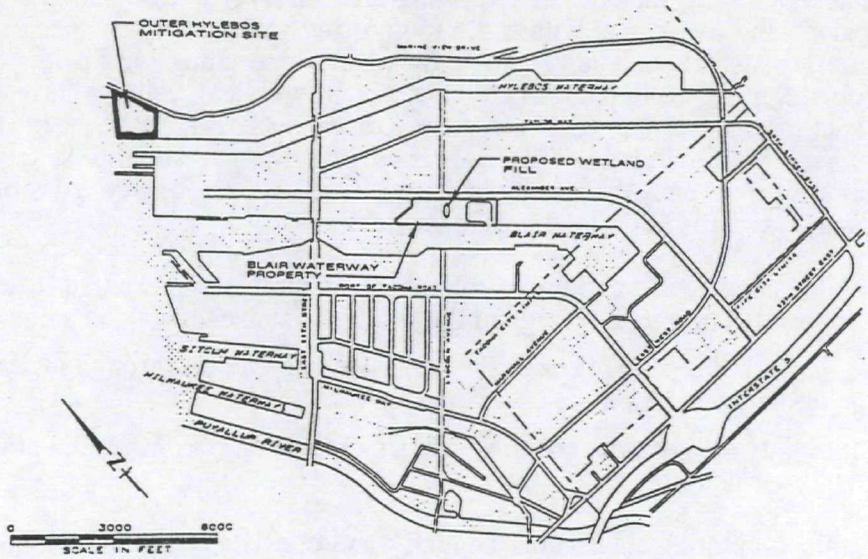


FIGURE 1. VICINITY MAP

METHODS

Mitigation monitoring for the project involves the following aspects of the overall mitigation plan.

1. Vegetation Monitoring
2. Topographical Monitoring
3. Hydrologic Monitoring
4. Seasonal Wildlife Observations

Vegetation monitoring occurs once in late spring and again in the fall of each monitoring year. Vegetation monitoring is focused on five permanent monitoring stations. Each of these areas represents different aspects of the completed planting and was randomly selected within the stratum to be monitored. The individual areas to be monitored are circular with a diameter of eleven (11) feet. Figure 2 illustrates the locations of the five monitoring stations and topographic monitoring transects of the original mitigation project.

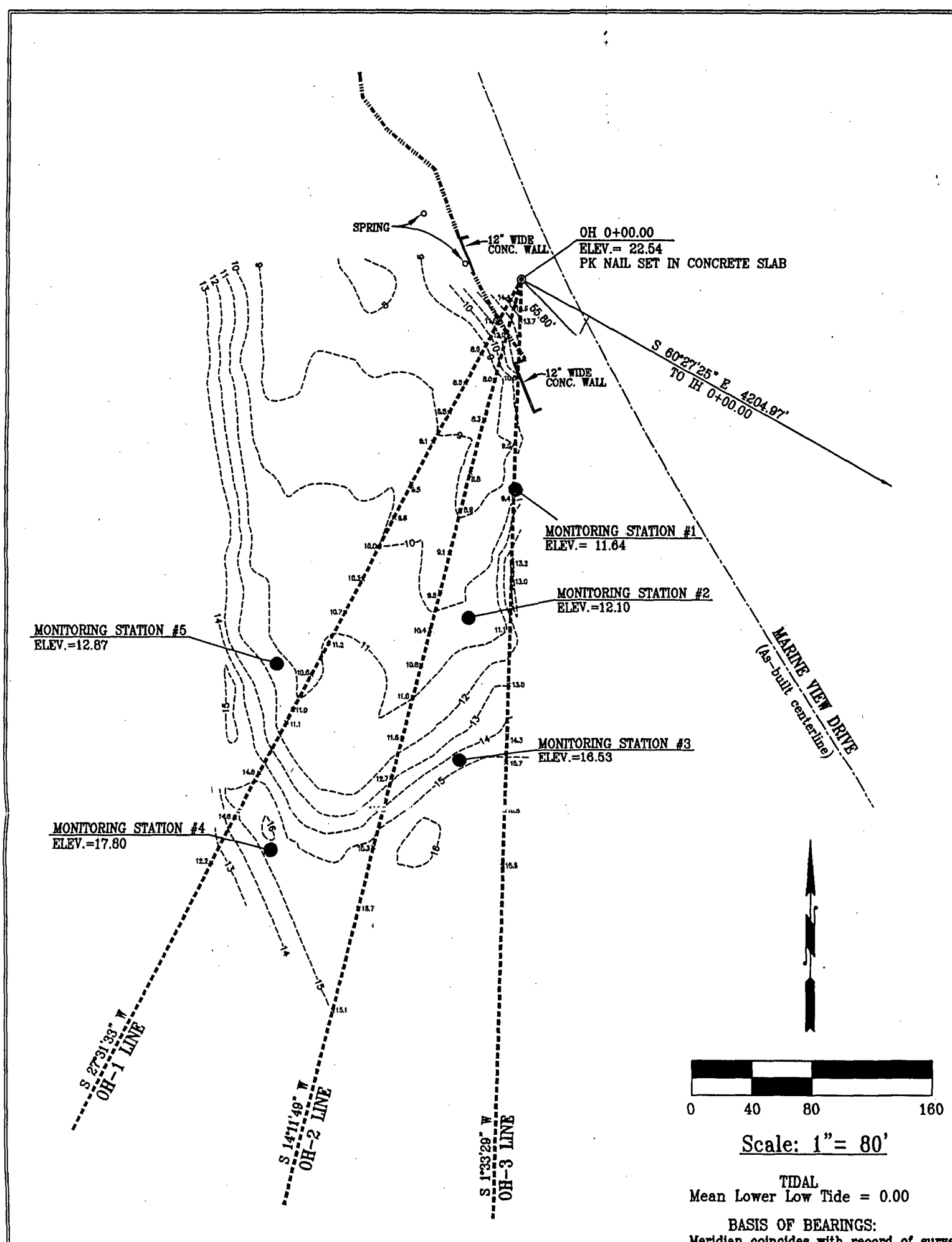
One-half inch rebar posts were installed to mark the observation areas for consistent data collection over time. However, a thorough assessment of the entire restoration area was made to determine the overall success and growth of the planting. After each monitoring effort, vegetation distribution data are illustrated on a computer graphic overlay to allow for comparison from year to year.

The primary method of monitoring is a photographic record of each station. Four photographs are taken of each station representing the compass orientations to view all sides of the plots. The photos will be compared over time to provide a visual record of survival, growth and success of the plants in the mitigation area.

Vegetation monitoring includes determining the survival of the mitigation plantings by counting dead and live plants within the monitoring stations. Each species planted within the monitoring station will be recorded by plant name along with an assessment of the general condition of each plant such as new growth and yellow leaves. Undesirable species such as reed canary grass *(Phalaris arundinacea),* Himalayan blackberry *(Rubus discolor)* and Scot's broom *(Cytisus scoparius)* will be identified, counted, percent coverage estimated and then removed by hand to the extent possible. Coverage performance standards as defined below must be met.

1. Invasive, exotic and undesirable species shall be represented by less than ten (10) percent coverage in the restored/enhanced wetland area.
2. Eighty (80) percent survival of all planted materials throughout the monitoring period.
3. Eighty (80) percent cover of species representative of the area prior to construction.

Topographic monitoring also occurs annually and consists of three set transects within the mitigation area (shown in Figure 2). Topographic records will be obtained annually during low tide to assess site stability and any other changes that occur over time. Topography will be measured to the one-foot increment to allow for easy comparison over time.



TIDAL
Mean Lower Low Tide = 0.00

BASIS OF BEARINGS:
Meridian coincides with record of survey recorded in volume 593, page 703, under Pierce County Auditor's file No. 900216083

Legend

- 1/2" Rebar set by Applied Environmental Services
- -----15----- Existing Ground Contours (1' intervals)
- ×6.4 Existing Ground Spot Elevations
- Line of Pre-Existing Vegetation
- ---------- Topographic Monitoring Transects

Original drawing by N.L. Olson & Associates, Inc.

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DRAWN BY:	CHECKED BY:	DATE:
ATO	WSW	4/2/98

APPLICATION BY:	THE PUYALLUP TRIBE OF INDIANS 2002 East 28th Street Tacoma, WA 98404
PROJECT:	LINCOLN DITCH MITIGATION
PROJECT LOCATION:	S22, 26 and 27, T21N AND R3E PIERCE COUNTY, WA

OUTER HYLEBOS SITE WETLAND MITIGATION PLAN

Hydrologic monitoring (a summer inspection during extreme high and low tide) is made along established benchmarks within the mitigation area to record water elevations. The data is then considered in connection with the vegetation species planted to determine if proper placement within the tidal area has been achieved.

Wildlife observations are made seasonally each year. Wildlife observations include frequency of occurrence and estimated numbers using the site and habitat of interest. Any indirect signs of wildlife observed such as burrows, nests, and evidence of browsing or signs of scat are also recorded. This information is then compiled into a comparative spreadsheet.

Results of all monitoring events will be summarized in cumulative monitoring reports after the first, second, third and fifth years, with a final report after the seventh year. An annual report is prepared and submitted for alternate years. Copies of each report will be sent to EPA and the Washington State Department of Fish and Wildlife for review. Should the desired mitigation goal, as defined by the monitoring program and performance standards not be achieved, a contingency plan will be implemented. The Puyallup Tribe of Indians will develop this contingency plan in consultation with the U.S. Environmental Protection Agency.

RESULTS

SUMMARY OF 1995 MONITORING EVENTS

The observations from 1995 monitoring events indicate that construction and revegetation planting were satisfactorily completed. Final site elevations were constructed according to plan. Site construction does not appear to have left any negative impacts on the hydrology of the area.

Planting followed the original plan with only two changes. No plant salvage was made because a reliable source for pickleweed *(Salicornia virginica)* was found and the price of new plants was favorable over the cost of plant salvage. Since onsite plants were not used, twice as many pickleweed were planted than what was called for on the planting plan. The revegetation was progressing as expected. There were no observed mortalities; there was significant new growth; and volunteer species were present. Volunteer species included: salmonberry *(Rubus spectabilis)*, gumweed *(Grindelia integrifolia)*, and miscellaneous grasses *(Gramineae* spp.*)*. All observed Scot's broom *(C. scoparius)* and Himalayan blackberry *(R. discolor)* were removed (by hand) from the restoration area by Puyallup Tribal staff and AES scientists periodically to maximize planting survival. Goose prints were observed in all five of the monitoring stations.

In addition to Canada geese *(Branta canadensis)*, a large number of other bird species were observed during the 1995 monitoring year. The Outer Hylebos wetland mitigation site appears to be utilized most heavily by various shorebirds as well as commonly observed crows *(Corvus brachyrhynchos)*, pigeons *(Columba* spp.*)*, swallows *(Hirundo* spp.*)* and robins *(Turdus migratorius)*. In addition to birds, several marine mammals, otters *(Enhydra lutris)* and harbor seals *(Phoca vitulina)* were also observed.

SUMMARY OF 1996 MONITORING EVENTS

The Outer Hylebos 1996 monitoring field events took place on February 17, April 29, July 16, September 27, and October 9, 1996. The region had been experiencing higher than normal precipitation levels for the past two winter-spring rainy seasons, resulting in mudslides and flooding in areas adjacent to the mitigation area.

The 1996 vegetation monitoring revealed a number of volunteer species present in the mitigation area. Volunteer species present included fat hen *(Atriplex patula)*, seaside plantain *(Plantago maritima)*, dandelion *(Taraxacum officinale)*, miscellaneous grasses *(Gramineae* spp.) and algae. The mitigation area also contained many Scot's Broom *(C. scoparius)* seedlings. Several wheelbarrow loads of Scot's broom *(C. scoparius)* were removed by hand.

Spring monitoring observations concluded that the mitigation planting was doing well. The pickleweed *(S. virginica)* was just beginning to emerge and the roses *(R. nutkana)*, twinberry *(L. involucrata)* and willow *(S. hookeriana)* appeared strong. The sedge *(Carex* spp.*)* and the saltgrass *(D. spicata)* were not doing well at this point. It may be possible that the saltgrass is reacting to sediment disturbances in the area as the logs that have been placed around the perimeter were moved. Approximately twenty-five percent of the logs were found higher in the zone while fifty percent were missing, which suggests storm and tidal disturbances. A significant number of plant mortalities were noted during the fall monitoring event. The cedars *(T. plicata)*, fleshy jaumea *(J. carnosa)*, saltgrass *(D. spicata)*, pickleweed *(S. virginica)* and sedge *(Carex* spp.*)* had zero percent survival. Mortalities are assumed to be a result of browsing geese that frequent the restoration site.

Goose prints were again observed in all of the vegetation monitoring areas. Large numbers of Canada geese *(B. canadensis)* as well as other common species such as crows *(C. brachyrhynchos)*, pigeons *(Columba* spp.*)*, swallows *(Hirundo* spp.*)* and robins *(T. migratorius)* were observed feeding and loafing in the vicinity of the mitigation site during all 1996 monitoring visits.

1997 MONITORING EVENTS

Monitoring events for 1997 took place on March 10, May 1, June 10, September 23 and November 13, 1997. The region was not experiencing unusual or extreme hydrographic conditions during the time of the monitoring events.

Vegetation was monitored in both the spring and fall of 1997. Spring monitoring observations show that the mitigation area is progressing fairly well. However, the sedge and saltgrass show no observed survival and the pickleweed *(S. virginica)* are not surviving to performance standards. Low survival percentages for these species was thought to be a combined result of moving logs, impacts resulting from tidal action, and foraging geese.

The evergreen trees planted around the perimeter of the mitigation area went from fifty-percent survival in the spring to ten-percent survival in the fall. The actual cause of death is unknown, but it is believed that excess salt in the soil and a lack of fresh water in the summer months is causing the trees to die off.

During the spring monitoring numerous volunteer species were observed. Volunteer species consisted of fat hen *(A. patula)*, seaside plantain *(P. maritima)*, western dock *(Rumex occidentalis)*, dune tansy *(Tanacetum bipinnatum)*, dandelion *(T. officinale)*, small flowered lupine *(Lupinus polycarpus)*, common vetch *(Vicia sativa)*, miscellaneous grasses *(Gramineae* spp.*)* and algae. The mitigation area also contained many Scot's broom *(C.scoparius)* plants, especially monitoring stations 3 and 4. Some goose prints *(B. canadensis)* were observed in the mitigation area; however, there were no birds resting or loafing in the vicinity of the restoration during the time of the monitoring event. Rebar stakes for stations 4 and 5 were missing so vegetation information for these stations was approximate.

Some topographic change was noted in 1997. Several areas of erosion were located adjacent to Marine View Drive. It is believed that erosion in this area is a result of high water flows during winter storm events and modification to the hillside. The hillside required stabilization measures due to several slope failures in the area. It appears that most of the soil that was eroded flowed toward the channel and was deposited in the spit area. Almost one foot of sediment was deposited in the vicinity of the planted sedge and pickleweed. It is believed that this may be one of the contributing factors in the species die off.

Vegetation monitoring station 3 was used as a hydrologic reference point due to its location at the intertidal and upland interface. Species planted at vegetation monitoring station 3 include both asters *(A. subspicata)* and twinberry *(L. invulucrata)*. The asters *(A. subspicata)* represent the tidal portion and the twinberry *(L. involucrata)* the upland. Zonation placement was determined to be correct in 1996, since both species were thriving. Observations in 1997 indicate this statement is still accurate, since the asters *(A. subspicata)* and the twinberry *(L. involucrata)* have shown significant growth during the past year.

Wildlife observations for 1997 are similar to those in 1995 and 1996. The Outer Hylebos site is supporting a large number of bird species year round. This means that the mitigation site is providing adequate food and cover and the species observed have adapted to the

doesn't nec. prove adequate

created habitat. Although bird species were abundant, the large numbers of Canada geese that have been previously noted have decreased.

1998 MONITORING EVENTS

Monitoring Events for 1998 took place on May 16, 1998, August 17, 1998, November 1, 1998 and January 5, 1999. The region was not experiencing unusual or extreme hydrographic conditions during the time of the monitoring events. A cumulative progress report will not be provided for 1998.

Vegetation

Vegetation was monitored in both the spring and fall of 1998. Spring monitoring observations show that the mitigation area is not progressing as well as last year. The sedge and saltgrass continue to show no observed survival and the pickleweed is also at zero percent survival. Photographs for the spring monitoring event are presented in Appendix A. Please note that the camera battery failed and incorrect date was recorded on the photographs. However they have since been amended and now reflect the correct date. Survival percentages for each species are presented below in Table 1.

TABLE 1. OUTER HYLEBOS VEGETATION (% SURVIVAL) SPRING 1998

SCIENTIFIC NAME	COMMON NAME	% SURVIVAL
Salicornia virginica	pickleweed	0%
Jaumea carnosa	fleshy jaumea	0%
Distichilis spicata	saltgrass	0%
Carex lyngbye	Lyngbye's sedge	0%
Carex obnupta	slough sedge	0%
Aster subspicata	Douglas aster	65%
Lonicera involucrata	twinberry	80%
Rosa nutkana	Nootka rose	95%
Salix hookeriana	Hooker's willow	90%
Crategus douglasii	black hawthorn	0%
Alnus rubra	red alder	80%
Thuja plicata	western red cedar	10%
Tsuga heterophylla	western hemlock	0%

The evergreen trees along the perimeter have not recovered. Salinity is believed to be the cause of death. The hemlock *(T. heterophylla)* remains a zero percent survival and the western red cedar *(T. plicata)* is at ten percent survival. As in the 1997 monitoring report it is recommended that these species be replaced with more salt tolerant species such as shore pine *(Pinus contorta)*, big-leaf maple *(Acer macrophyllum)*, vine maple *(Acer circinatum)* and Pacific crab apple *(Malus fusca)*.

During the spring monitoring volunteer species were observed. Volunteer species consisted of fat hen *(A. patula)*, seaside plantain *(P. maritima)*, western dock *(R. occidentalis)*, dune tansy *(T. bipinnatum)*, small flowered lupine *(L. polycarpus)*, common vetch *(V. sativa)*, miscellaneous grasses *(Gramineae* spp.*)* and algae. The mitigation area also contained many Scot's broom *(C. scoparius)* plants as well as several Himalayan blackberry *(R. discolor)*. Removal of these invasive plants will need to be implemented before they become uncontrollable and negatively affect the restoration area.

Table 2 below summarizes the vegetation observations during the spring monitoring event. Although some goose prints were observed there were no birds in the vicinity of the restoration during the time of the monitoring event. Rebar stakes for stations 4 and 5 were missing so vegetation information for these stations was approximate.

TABLE 2. OUTER HYLEBOS RESTORATION VEGETATION STATUS SPRING 1998

MONITORING STATION	OBSERVATIONS (COMMENTS)	VOLUNTEER SPECIES	INVASIVE SPECIES	VEGETATION COVER
Station 1 sedge species	No observed survival	Algae	No invasives observed	(5%)
Station 2 Pickleweed	No observed survival	Algae	No invasives observed	(5%)
Station 3 Aster Saltgrass Twinberry	Aster are doing fair twinberry and saltgrass within the monitoring station area have failed	Misc. grasses common dock plantain	Scot's Broom	(100%)
Station 4 Rose Twinberry	Rose and twinberry within the monitoring station have failed	Misc. grasses Plantain Common dock	Scot's Broom	(100%)
Station 5 Saltgrass	No observed survival	Algae	No invasives observed	(40%)

Note: Invasive species found in the restoration area were too numerous for an accurate count or for attempt to remove by hand.

The results of the fall vegetation monitoring are shown below in Tables 3 and 4. Table 3 illustrates survival percentages for the fall monitoring. Table 4 summarizes the observations noted during the fall monitoring event.

TABLE 3. OUTER HYLEBOS VEGETATION (% SURVIVAL) FALL 1998

SCIENTIFIC NAME	COMMON NAME	% SURVIVAL
Salicornia virginica	pickleweed	0%
Jaumea carnosa	fleshy jaumea	0%
Distichilis spicata	saltgrass	0%
Carex lyngbye	Lyngbye's sedge	0%
Carex obnupta	slough sedge	0%
Aster subspicata	Douglas aster	65%
Lonicera involucrata	twinberry	80%
Rosa nutkana	Nootka rose	95%
Salix hookeriana	Hooker's willow	90%
Crategus douglasii	black hawthorn	0%
Alnus rubra	red alder	80%
Thuja plicata	western red cedar	10%
Tsuga heterophylla	western hemlock	0%

Fall vegetation monitoring photographs were similar to those taken in the spring (see Appendix A). Planted species as well as volunteer species were doing well, except for the sedge species *(Carex spp.),* pickleweed *(S. virginica),* and saltgrass *(D. spicata)* and evergreen trees. The evergreen trees planted around the perimeter of the mitigation area went from fifty-percent survival in the spring to ten-percent survival in the fall. The actual cause of death is unknown, but it is believed that excess salt in the soil and a lack of fresh water in the summer months is causing the trees to die off.

TABLE 4. OUTER HYLEBOS RESTORATION VEGETATION STATUS FALL 1998

MONITORING STATION	OBSERVATIONS (COMMENTS)	VOLUNTEER SPECIES	INVASIVE SPECIES	VEGETATION COVER
Station 1 sedge species	No observed survival	No volunteers observed	No invasives observed	(0%)
Station 2 Pickleweed	No observed survival	No volunteers observed	No invasives observed	(0%)
Station 3 Aster Saltgrass Twinberry	Aster are doing fair twinberry and saltgrass within the monitoring station area have failed	Misc. grasses Dock Plantain	Scot's Broom	(100%)
Station 4 Rose Twinberry	Rose and twinberry within the monitoring station have failed	Misc. grasses Plantain Dune tansy Western dock	Scot's Broom	(100%)
Station 5 Saltgrass	No observed survival	No volunteers observed	No invasives observed	(0%)

Note: Invasive species found in the restoration area were too numerous for an accurate count or for attempt at removal by hand.

In addition to the above vegetation information, computer generated drawings illustrating species distribution for 1998 have also been included (Appendix B).

Topography

Figures 3, 4, and 5 are the topographic profiles for 1995, 1996, 1997 and 1998 monitoring events. A profile of each transect is provided to illustrate any topographic changes (see Figure 2 for topographic transect locations). Survey data was taken along the same transects for all three years. This data was then transferred to AutoCad LT and plotted as a profile to visually illustrate significant changes in topography. Topographic changes not only provide information regarding soil accumulation and deposition but also information about plant zonation and survival, hydrology patterns, etc.

The topographic profiles for 1998 illustrate that minimal erosion and deposition occurred. Figures 3, 4, and 5 indicate that no changes equal to or greater than one foot took place. This indicates that the topography for 1998 remained stable despite adjacent construction activities which were a concern earlier in the year.

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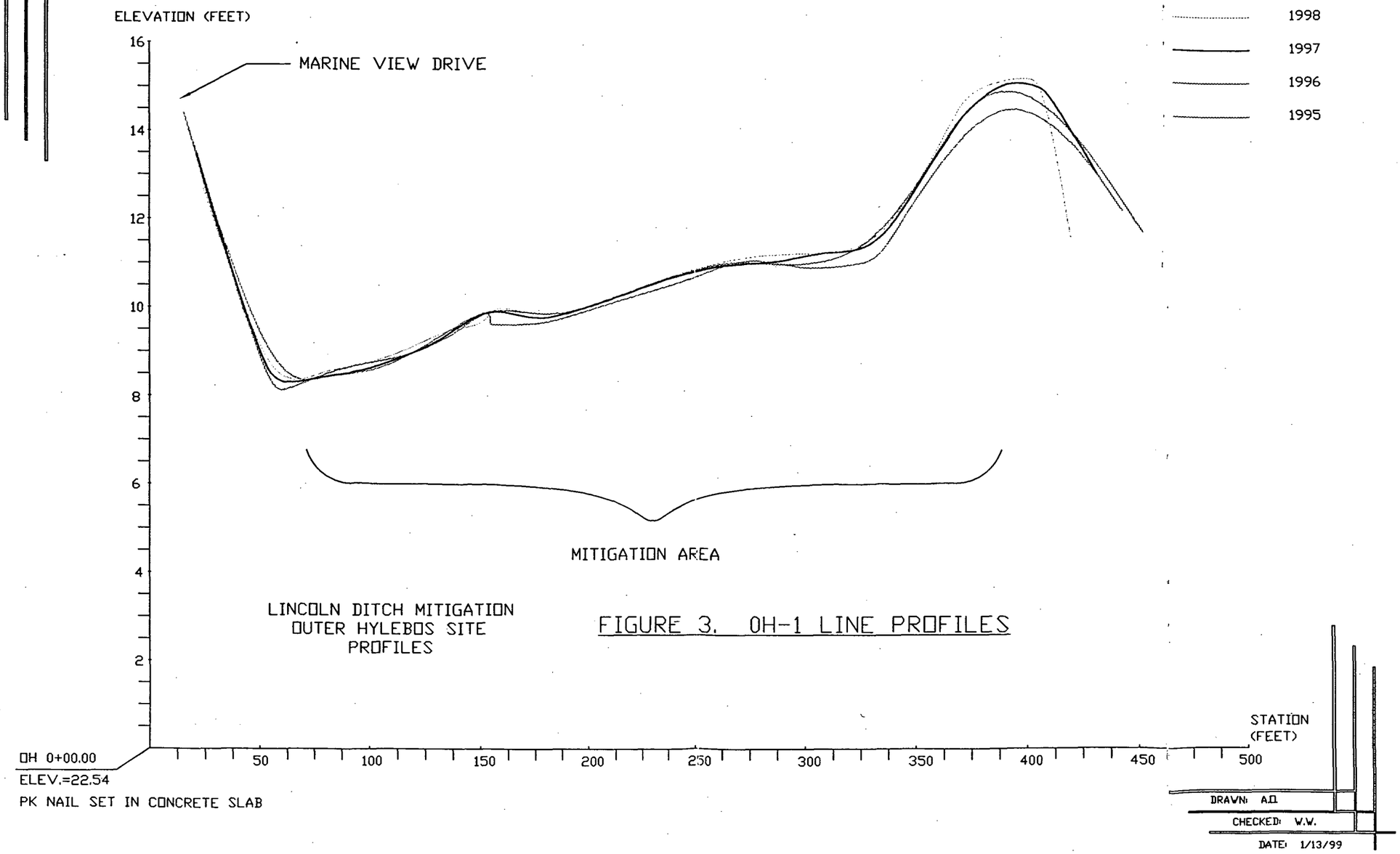
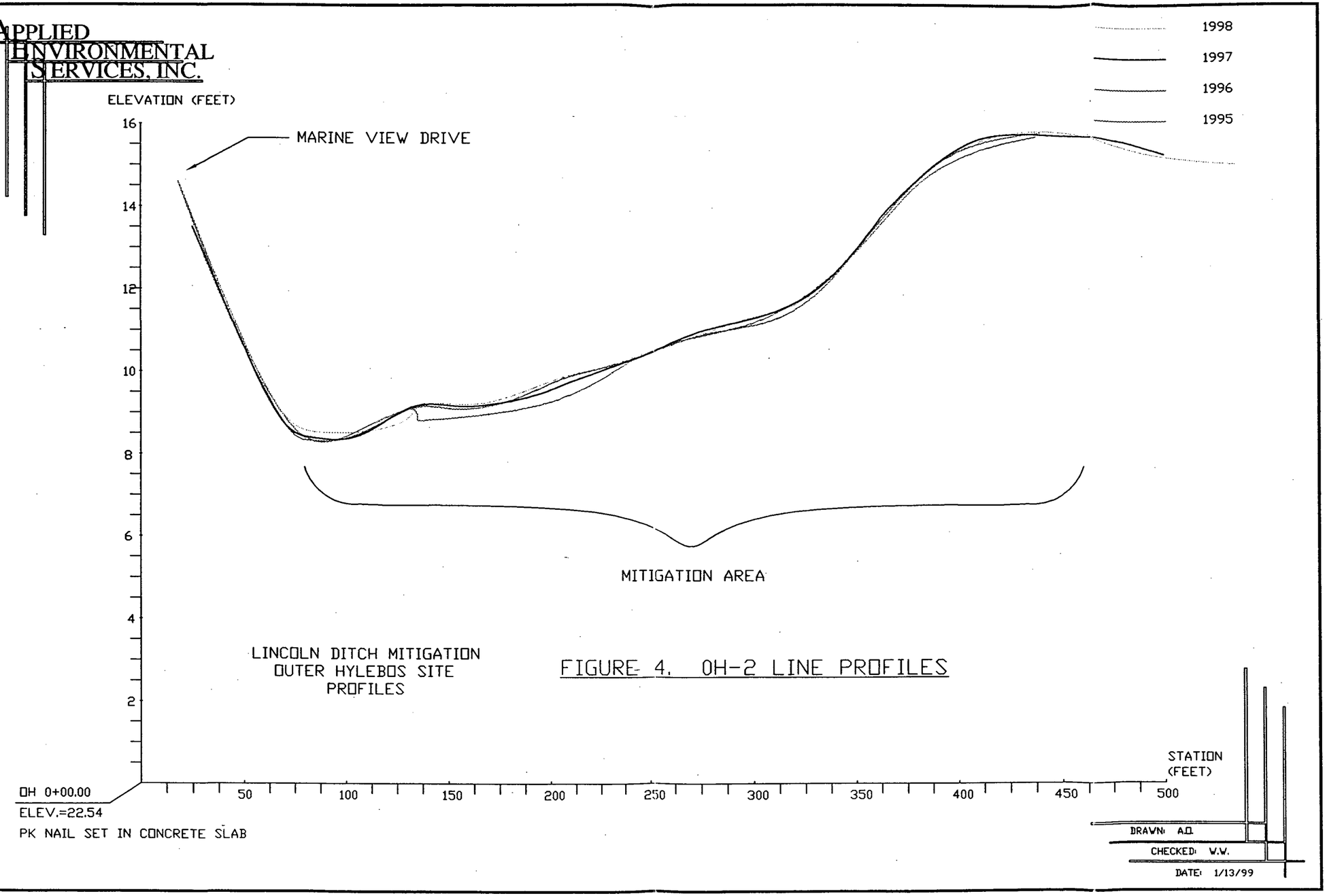


LINCOLN DITCH MITIGATION
OUTER HYLEBOS SITE
PROFILES

FIGURE 3. OH-1 LINE PROFILES

APPLIED ENVIRONMENTAL SERVICES, INC.



LINCOLN DITCH MITIGATION
OUTER HYLEBOS SITE
PROFILES

FIGURE 4. OH-2 LINE PROFILES

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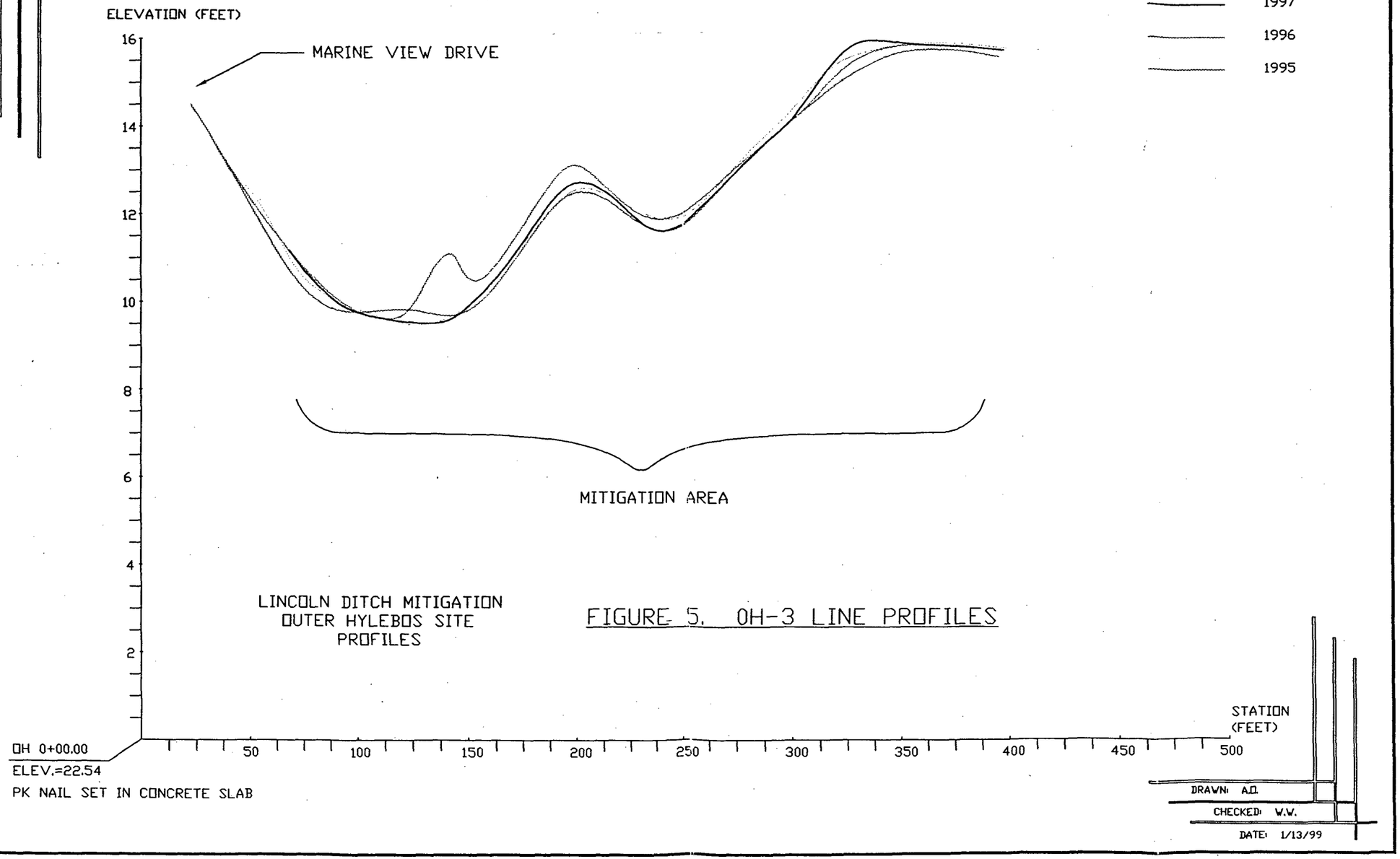

LINCOLN DITCH MITIGATION
OUTER HYLEBOS SITE
PROFILES

FIGURE 5. OH-3 LINE PROFILES

Hydrology

Vegetation monitoring station 3 was used as a hydrologic reference point due to its location at the intertidal and upland interface. Species planted at vegetation monitoring station 3 include both asters *(A. subspicata)* and twinberry *(L. invulucrata)*. The asters represent the tidal portion and the twinberry the upland. Zonation placement was determined to be correct in 1996, since both species were thriving. Observations in 1998 indicate this statement is still accurate, since the asters and the twinberry have shown significant growth during the past year. However, due to impacts resulting from Scot's broom removal and severe storm events several mortalities were noted.

Wildlife

Wildlife observations for 1998 are similar to those in previous years. The Outer Hylebos site is supporting a large number of bird species year round (Figure 6). This means that the mitigation site is providing adequate food and cover and the species observed have adapted to the created habitat. Although bird species were abundant, the large numbers of Canada geese *(B. canadensis)* that were previously noted have decreased since 1996. Wildlife species observed during the 1998 monitoring are included in Table 13 (page 19). As noted in Table 5 the number of bird species noted during the winter monitoring event was low. This was believed to be a result of an excessive amount of boat activity in the area. The boat activity during the winter monitoring event was significantly greater during the winter event than during any other of the 1998 monitoring events.

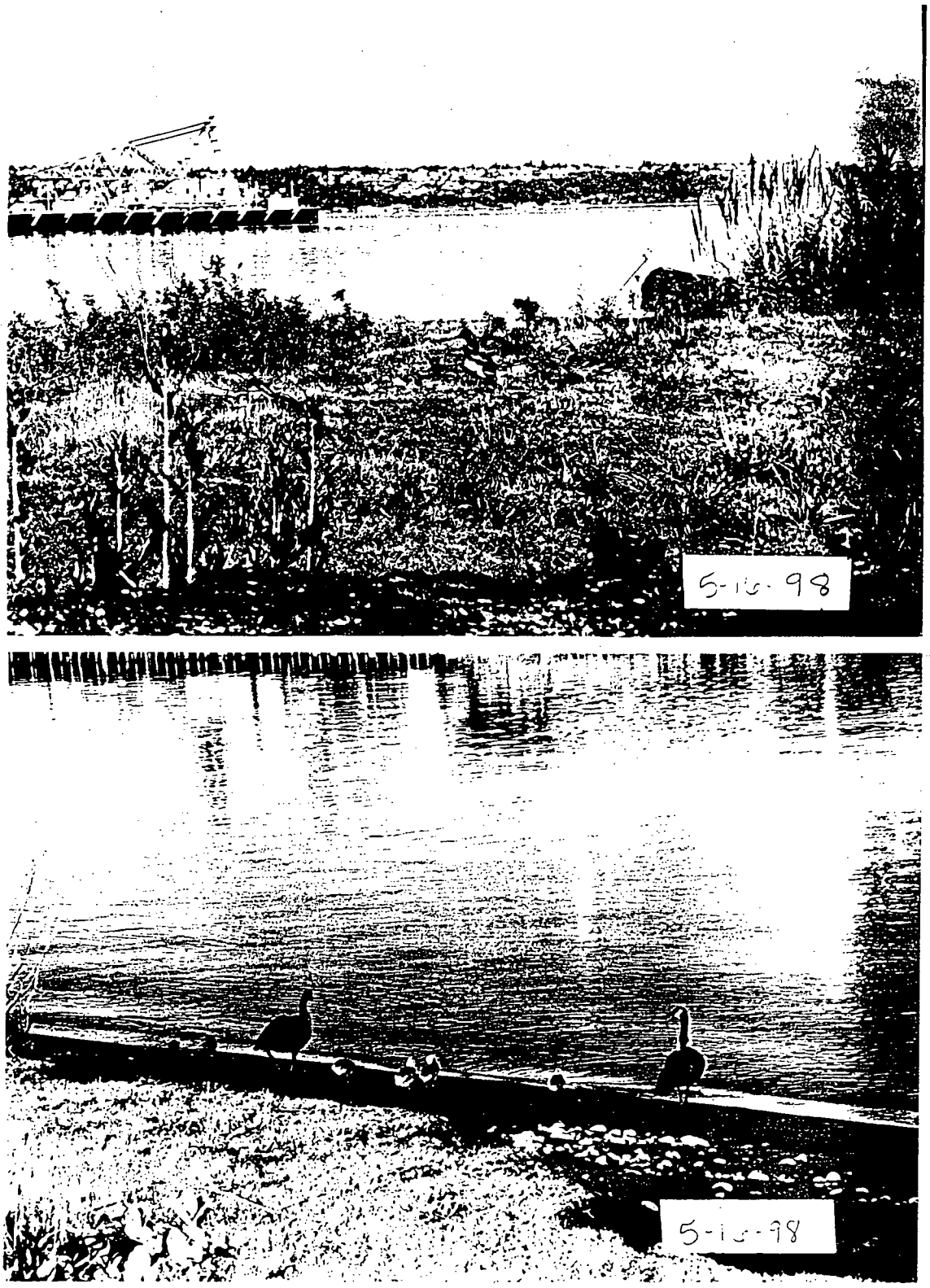

FIGURE 6. SPRING WILDLIFE OBSERVATIONS

OUTER HYLEBOS 4TH MONITORING REPORT - 1998

TABLE 5. 1998 OUTER HYLEBOS WILDLIFE OBSERVATIONS

SPECIES	NUMBER	DATE OBSERVED	HABITAT USED	EXPECTED FREQUENCY
killdeer *(Charadruis wilsona)*			uses beaches and marshes for feeding	year round
Canada geese *(Branta canadensis)*	13 1 3	5/16/98 8/17/98 11/1/98	uses beaches and marshes for feeding	during migration
mallard ducks *(Anas platyrhynchos)*	2 (m)-2(f) 16 1(m)-1(f)	5/16/98 8/17/98 1/5/99	common in fresh water marshes	year round
great blue herons *(Ardea herodias)*	1 1 1	5/16/98 8/17/98 11/1/98	uses bays (shallows) and salt marshes for feeding	year round
herring gulls *(Larus aregentatus)*	20 1 3	8/17/98 11/1/98 1/5/99	common along coast	year round
spotted sandpiper *(Actitis macularia)*	1	8/17/98	common along freshwater, salt marshes, mudflats and beaches	spring and summer
domestic pigeon *(Colombia livia)*			uses beaches for feeding	year round
songbirds *(Passeriformes spp.)*	10	1/5/99	Uses beaches for feeding	spring and summer
cliff swallows *(Hirundo pyrrhonota)*			uses eves of buildings to nest	spring and summer
kingfisher *(Ceryle alcyon)*	1(m) 1	5/16/98 8/17/98	uses bays and shallows for feeding	year round
band-tailed pigeons *(Columbia fasciata)*			uses beaches for feeding and nearby trees or buildings for nesting	year round
American crow *(Corvus brachyrhynchos)*	1 7 4 4	5/16/98 8/17/98 11/1/98 1/5/99	uses beaches for feeding	year round
American robin *(Turdus migratorius)*			uses marshes for feeding	year round
American goldfinch *(Carduelis tristis)*			common in fields and bushes	year round
American coot *(Fulica americana)*	4	1/5/99	common along freshwater winters on salt water	winter
Black-capped chickadee *(Parus atricapillus)*	2	8/17/98	common in woodlands	fall and winter
European starling *(Sturnus vulgaris)*	1	5/16/98	common in developed areas	year round
house finch *(Carpodacus mexicanus)*			common in bottomlands and urban areas	year round
barn swallows *(Hirundo rustica)*	1	5/16/98	uses boathouses for nesting	spring and summer
tree swallow *(Tachycineta bicolor)*	3 9	5/16/98 8/17/98	common near water	spring and summer
bank swallows *(Riparia riparia)*			found near steep banks	spring and summer
bufflehead *(Bucephala albeola)*			common in tidewaters	winter
pigeon Guillemot *(Cepphus columba)*			commonly seen in coastal waters	year round

DISCUSSION

1996 Monitoring

The 1996 monitoring results indicate that a number of volunteer species were observed throughout the mitigation area. Volunteer species included fat hen *(A. patula),* seaside plantain *(P. maritima),* dandelion *(T. officinale),* miscellaneous grasses *(Gramineae* spp.*)* and algae.

By fall of 1996 it was determined that the mitigation goal for this area was not being achieved. Eighty-percent survival for eight of the thirteen species planted was not attained. The following tree species, cedar *(T. plicata),* hemlock *(T. heterophylla),* and alder *(A. rubra)* showed zero percent survival. The possibility of salt presence in the soil combined with extreme summer temperatures and lack of rainfall are likely causes for the die off.

Emergent intertidal species were also surviving poorly. Saltgrass *(D. spicata),* sedge *(Carex* spp.*)* fleshy jaumea *(J. carnosa)* and pickleweed *(S. virginica)* all had zero percent observed survival. Poor survival of the saltgrass and fleshy jaumea *(J. carnosa)* is likely the result of storm impacts (log movement within the tidal zone). Poor plant survival for the pickleweed *(S. virginica)* and sedge species *(Carex* spp.*)* was determined to most likely be the result of browsing geese. Canada geese *(B. canadensis)* were observed onsite during every monitoring event. Goose tracks were observed throughout the pickleweed and sedge planting areas, where there was evidence of whole plant uprooting and cropping.

It was recommended that goose exclosures be implemented to offer some protection and increase plant survival. Goose exclosures are currently the most common remedy for herbivory of nearshore plants in protected areas.

1997 Monitoring

The 1997 monitoring results show that the volunteer species are successfully vegetating portions of the mitigation area. Several new species, in addition to those observed in previous years, were noted: lupine *(L. polycarpus),* common vetch *(V. sativa),* westerm dock *(R. occidentalis),* dune tansy *(T. bipinnatum)* and fleshy jaumea *(J. carnosa).*

Following the fall 1996 monitoring event several tree and shrub species at the mitigation site were replanted by the landscape contractor. Table 13 below illustrates the plants that were replanted.

TABLE 6. REPLANTED MITIGATION VEGETATION (1996)

Scientific Name	Common Name	Size	# Planted
Lonicera invulucrata	Twinberry	1 gallon	25
Rosa nutkana	Nootka rose	1 gallon	34
Rosa nutkana	Nootka rose	2 gallon	30
Salix hookeriana	Hooker's willow	1 gallon	2
Alnus rubra	Red alder	2 gallon	18
Thuja plicata	Red cedar	4 foot	6
Tsuga heterophylla	Western hemlock	4 foot	6

Of the replanted species, the twinberry, nootka rose; willow and alder are doing well and show significant new growth. Of the cedar and hemlock, only one cedar was alive and it did not appear to be healthy. Salinity is believed to be the cause of death in the coniferous

species. Cedars have some tolerance to saline soil; however hemlocks have no salt tolerance (personal communication with Country Nursery and Garden). The area in which the coniferous species are planted probably floods occasionally during extreme storm events; therefore resulting in occasional salt buildup. The salt concentration required to eliminate a particular species from a site need not occur often or persist for more than a few hours or days (Knutson and Woodhouse 1983). It has been determined that future plants selected, even those along the outer fringe area, will require at least some salt tolerance. Trees recommend for planting in this area include: shore pine *(Pinus contorta),* big-leaf maple *(Acer macrophyllum),* vine maple *(Acer circinatum)* and Pacific crab apple *(Malus fusca)* (Pojar and MacKinnon et al. 1994).

The planted emergent species have not recovered from the previous year. The pickleweed and sedge remain at zero percent-observed survival. In March of 1997 (approximately one month after the spring monitoring event) the emergent areas appeared to be recovering as many small newly emerging plants were observed. However, as the data illustrates they did not last through the summer. The pickleweed failure is believed to be the impacts from storm events (log instability, wave and wind action and sedimentation) and browsing geese. Successful mitigation plans often require perseverance and patience. Storms can cause temporary setbacks, even on highly promising sites. In most cases damaged plantings can be replanted. Also it must be kept in mind that plantings will require one to three years to become established (Knutson and Woodhouse 1983).

It was noted in 1996 that the logs placed around the perimeter of the mitigation area had moved as a result of storm and tidal activity. Outer Hylebos Waterway has been used for log raft storage for many years. During storm events logs break loose from their holding areas occasionally grounding in the mitigation area. Log grounding, which is the settling of logs on the sediment surface of intertidal areas when the tide retreats, creates a direct disturbance to benthic habitat in nearshore areas (Shapiro 1992). This was also the case during the 1997 monitoring events. The sedge and saltgrass are located near the fourteen-foot and fifteen-foot tidal elevations. This is approximately the elevation where logs and other debris from the main channel finally settle after floating in during high tides and storms. This area is where most of the disturbance is taking place. To correct this problem and encourage vegetation establishment the tribe has proposed to anchor large woody debris in place to protect emergent vegetation from grounding logs and wind and wave action.

1998 Monitoring

The 1998 monitoring events have determined that the mitigation goal for this area is not being achieved. Eighty-percent survival for the planted species was not attained and invasive species account for more than ten-percent coverage in the restoration area.

During the spring and fall vegetation monitoring it was concluded that nine of thirteen planted species had below eighty-percent survival. Of those nine species the pickleweed *(S. virginica),* fleshy jaumea *(J. carnosa),* saltgrass *(D. spicata),* Lyngbye's sedge *(C. lyngbye),* slough sedge *(C. obnupta),* Douglas aster *(A. subspicata),* black hawthorn *(C. douglasii),* western red cedar *(T. plicata)* and western hemlock *(T. heterophylla)* all showed zero percent survival.

all 9 species

The Outer Hylebos site appears to support year round human activity. During the summer months, especially during the weekend of July 4th, the amount of refuse (beer cans, beer bottles, snack wrappers, potato chip bags and firework debris) appears to be the greatest. People sunbathing have also been observed during the summer months. During the winter months the amount of garbage observed is significantly less; however, footpaths appear to be used regularly.

Log movement and heavy debris are still problems at this site. During the winter monitoring event it was noted that the logs onsite have moved as a result of storm and tidal activity. With continued disturbance to the substrate plant survival in the intertidal area is not expected to be very high.

At one point it was suggested that a large woody debris (LWD) anchoring system be implemented to resolve several of the existing problems onsite. However, anchoring LWD is not as simple as it sounds. In tidal areas, a large (200-500 pound) piece of concrete is normally placed about ten to fifteen feet below grade with an eye bolt and cable attachment. However, at this exposed site, it is expected that scouring and/or sedimentation would occur around the logs. Sedimentation within the intertidal area may create more upland area which is not one of the goals of the mitigation plan. Therefore it was concluded that this was not an option to be considered.

Along the northeastern portion of the site, near monitoring stations 1 and 2, an oily sheen was noted (see photographs in Figure 7). There was also a distinct petroleum smell and black residue was observed on the soil. This was primarily noted along the eastern portion of the mitigation area. Due to the location of these observations it is believed that it may be caused by road runoff from Marine View Drive. These conditions are not unusual for an area located within a heavily utilized industrial zone. However, this could be a contributing factor to the failure of the pickleweed, fleshy jaumea, and sedge.

Invasive vegetation (Scot's broom and blackberry) is also a problem within the mitigation area. In 1997 a contractor was hired to remove the invasive Scot's broom. Ninety-five percent of the plants were removed by hand. Between the twelve-foot and sixteen-foot elevations mechanical means were employed. However, since the Scot's broom was well established, with mature root systems, many of the planted species were either pulled up or damaged during the removal effort. In spite of this effort the Scot's broom have appeared to have re-infested the site and many of the plants damaged during the removal effort have not recovered. The primary species impacted during removal effort was the twinberry *(L. involucrata)*. Some damage was also observed associated with Nootka rose *(R. nutkana)*.

The twinberry along the western edge of the mitigation site is not suviving as desired. The reason for the sudden loss is unknown; however, impacts are believed to be a result of extreme weather conditions (wind and wave action), soil salinity and human impacts.

In addition to Scot's broom *(C. scoparius)* several Himalayan blackberry *(R. discolor)* plants were observed within the mitigation area. It is believed that birds that were feeding on blackberry plants in nearby areas deposited the seeds. It is recommended that the plants be removed as soon as possible to prevent further infestation.

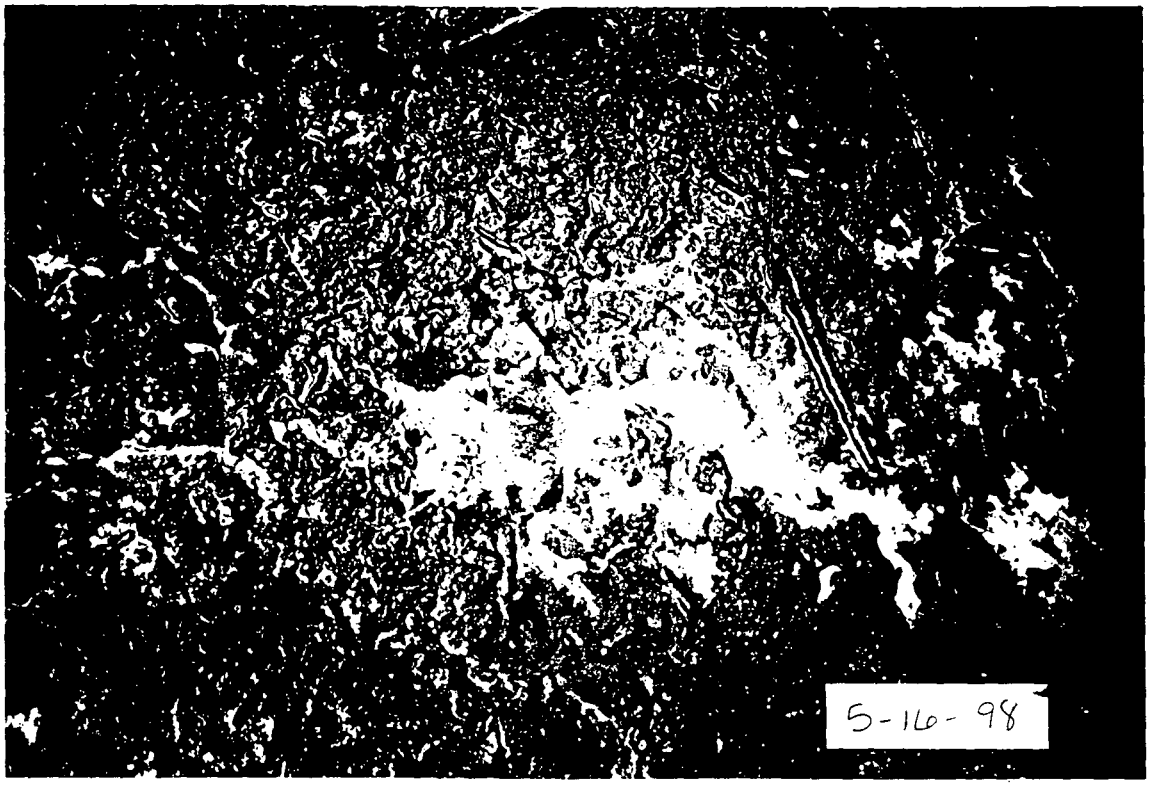

FIGURE 7. PETROLEUM PRODUCT RESIDUE

OUTER HYLEBOS 4TH MONITORING REPORT - 1998

1999 Monitoring

Monitoring for 1999 will be the same as previous years. Data collection will include vegetation, topographic, hydrologic, wildlife and photographic observations. Results of the monitoring events will be summarized in a yearly project report. Any planting or modification of the site will also be included in the report. A cumulative report will be provided for 1999. Cumulative reports are prepared for the second, third, and fifth years with a final report after the seventh year.

Summary

The initial success of the Outer Hylebos site has been reduced over time. Scot's broom *(C. scoparius)* poses a serious threat to the ultimate success of the mitigation. Root entanglement with the planted species prevents removal without damage to beneficial species. In addition, the Scot's broom competes with the planted species for nutrients, moisture and space. It is expected that the Scot's broom seed stock present in the soil is likely to pose a chronic problem at this site until planted species become well established. Corrective actions may require re-grading the site where Scot's broom is prevalent and replacing the topsoil with clean material and then selectively replanting.

Log deposition and goose predation has caused plant uprooting and plant mortality within the intertidal area. However, despite low plant survivability, the intertidal area is consistently used by a large number of bird species year round.

Stormwater runoff from Marine View Drive appears to be a possible source of pollutants to the mitigation area. However, the petroleum sheen was only observed during the spring monitoring event so that it may have been a result of extreme storm events. Spring 1999 monitoring events will determine whether this is an ongoing problem and needs to be addressed.

Additional solutions to those listed above may be developed in consultation with the Tribe and regulatory agencies. The activation of contingency measures may indicate the need to extend monitoring within the mitigation area.

Cumul. Reports
4yr 2nd 1996
3rd 1997
5th 1999
7th (final) 2001

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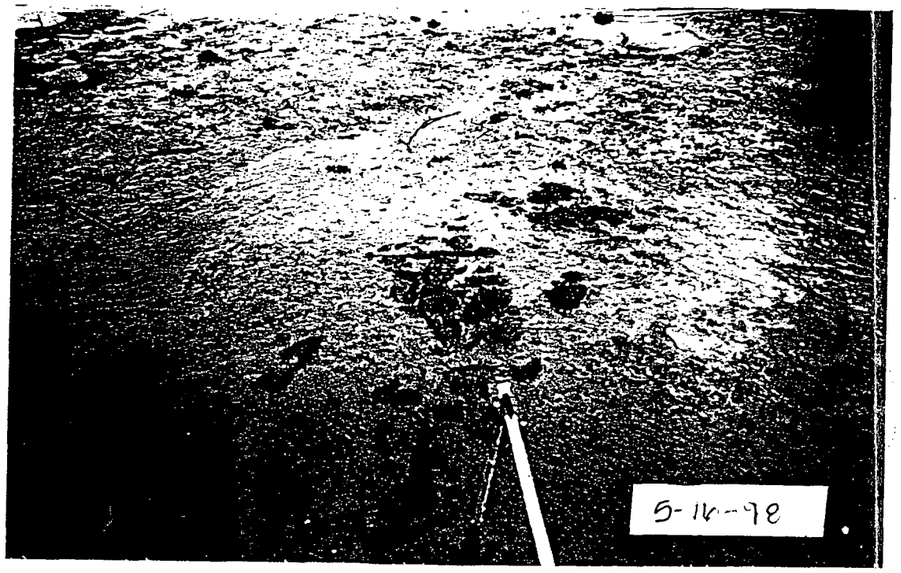
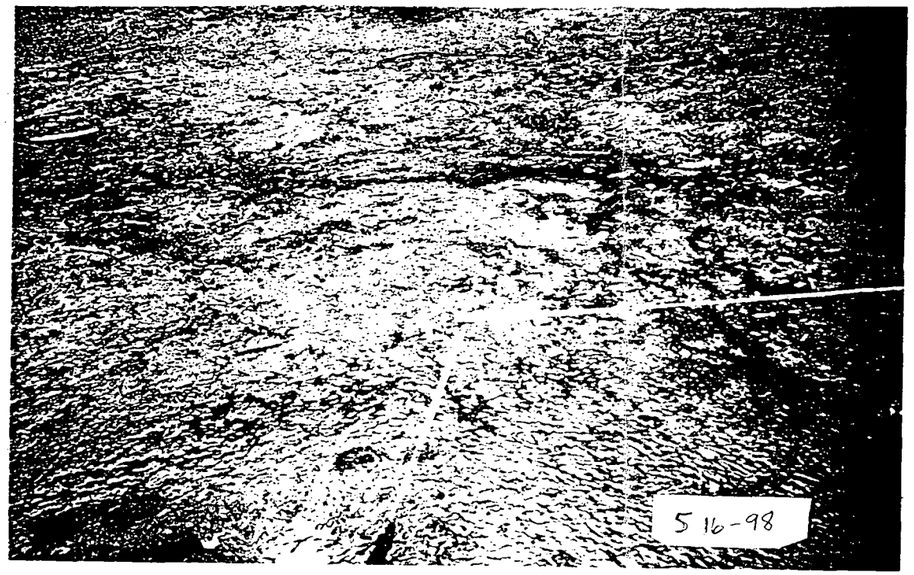
APPENDIX A
SPRING AND FALL VEGETATION MONITORING PHOTOGRAPHS

LOOKING NORTH





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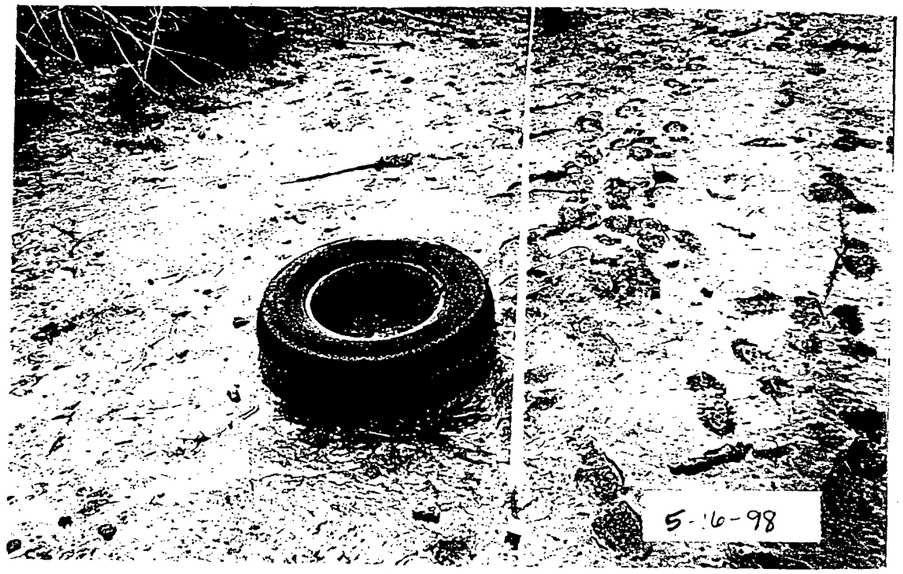

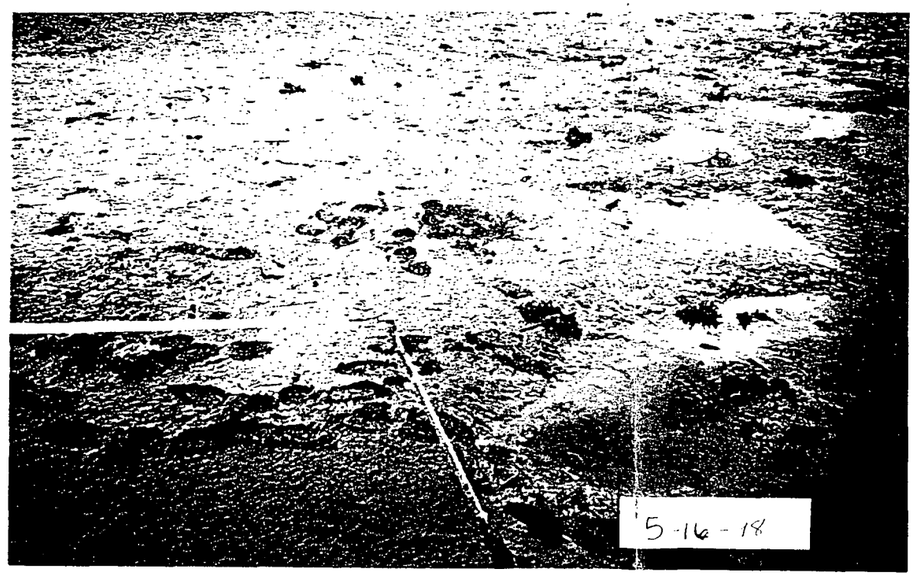

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OUTER HYLEBOS 4th MONITORING REPORT

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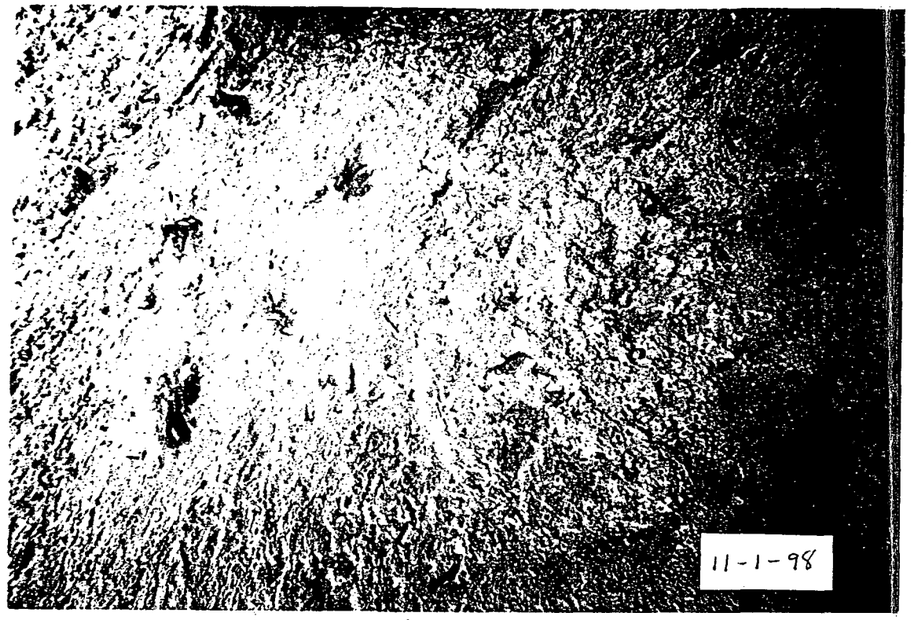

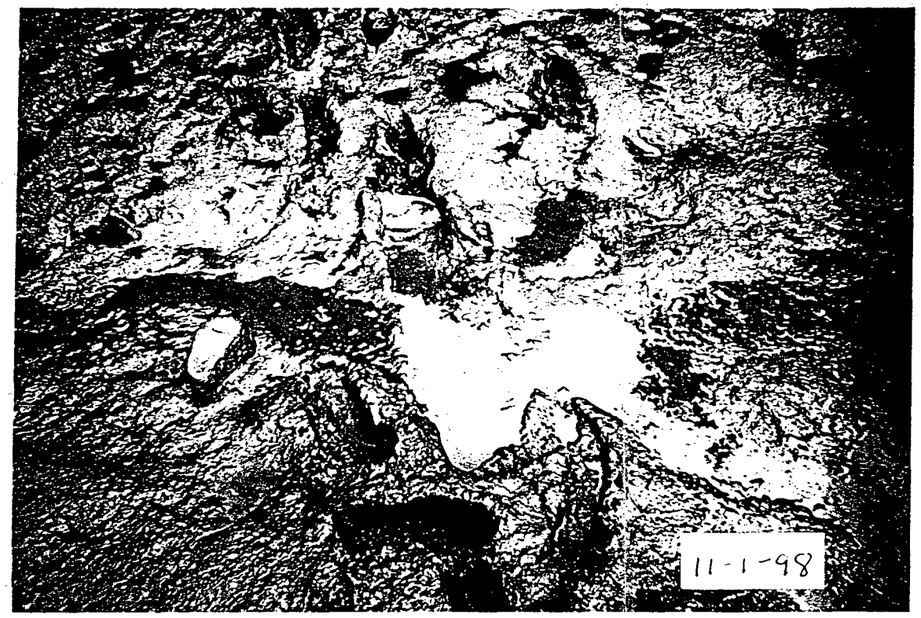

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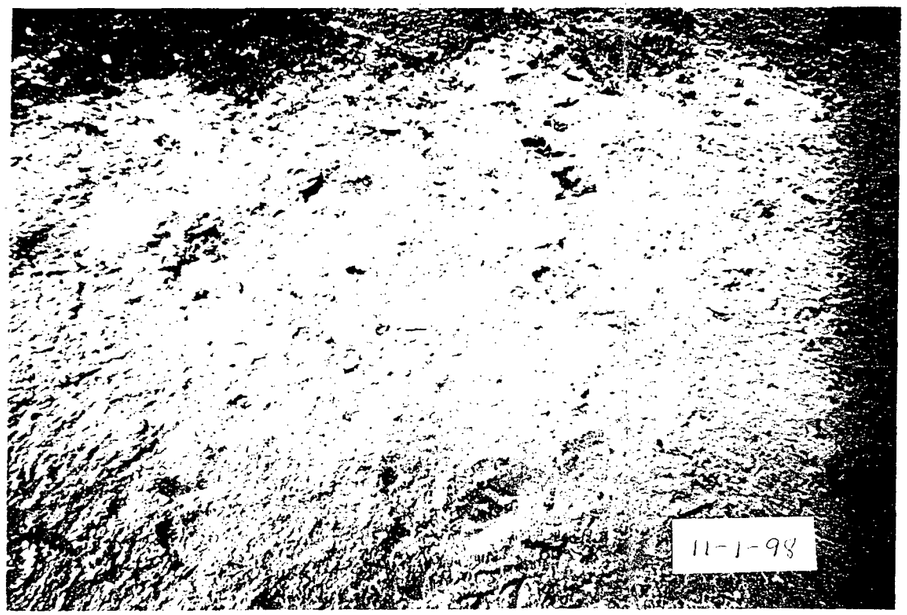

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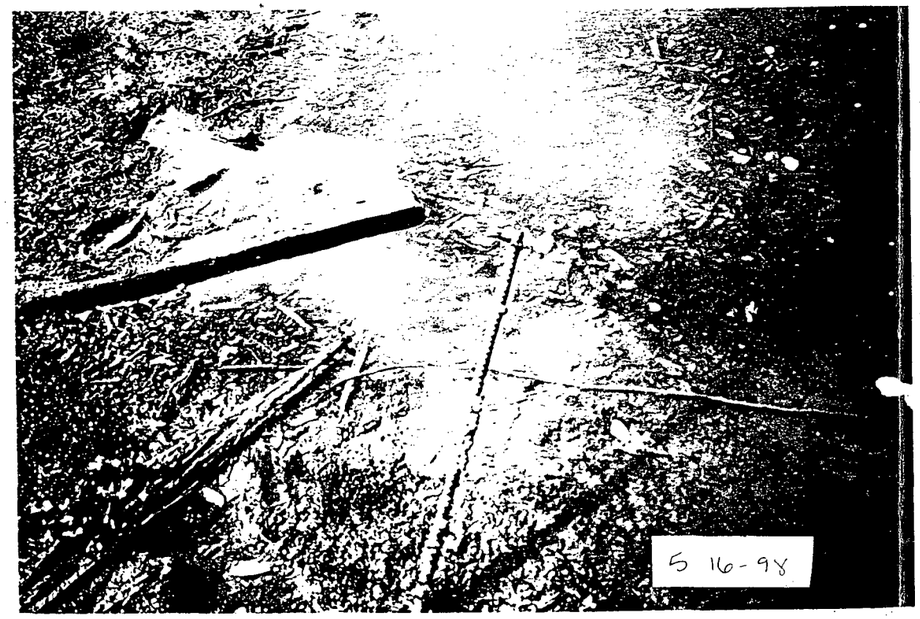

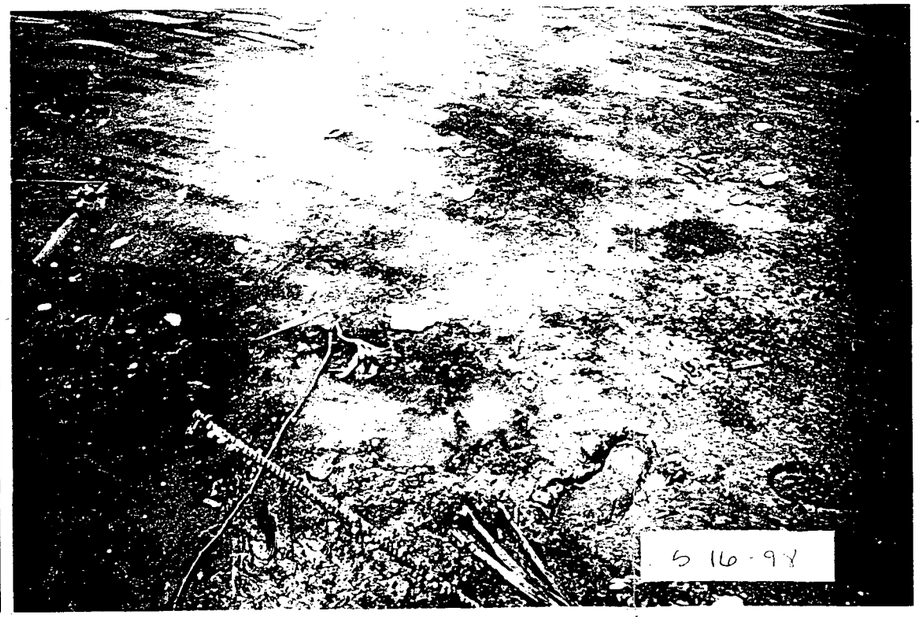

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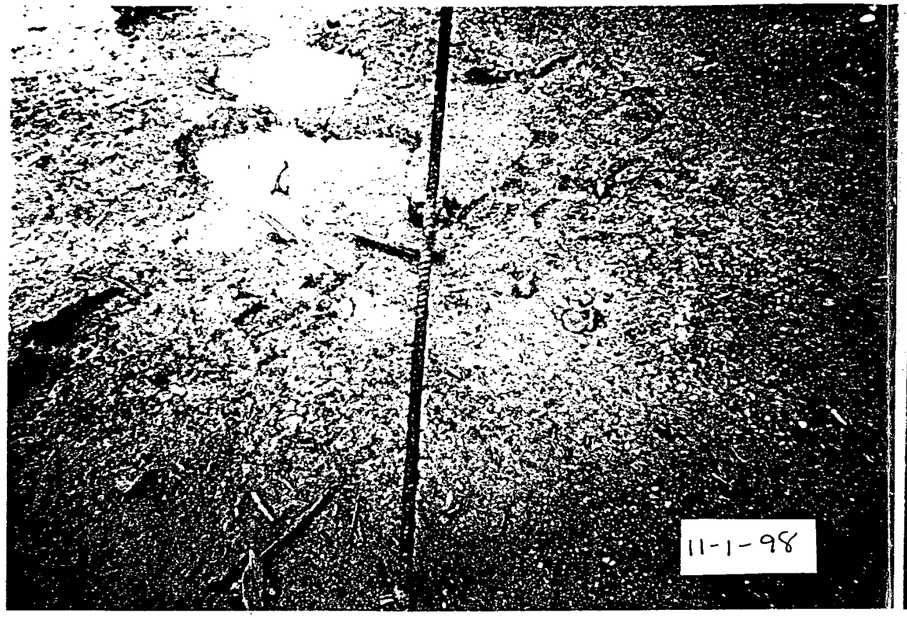

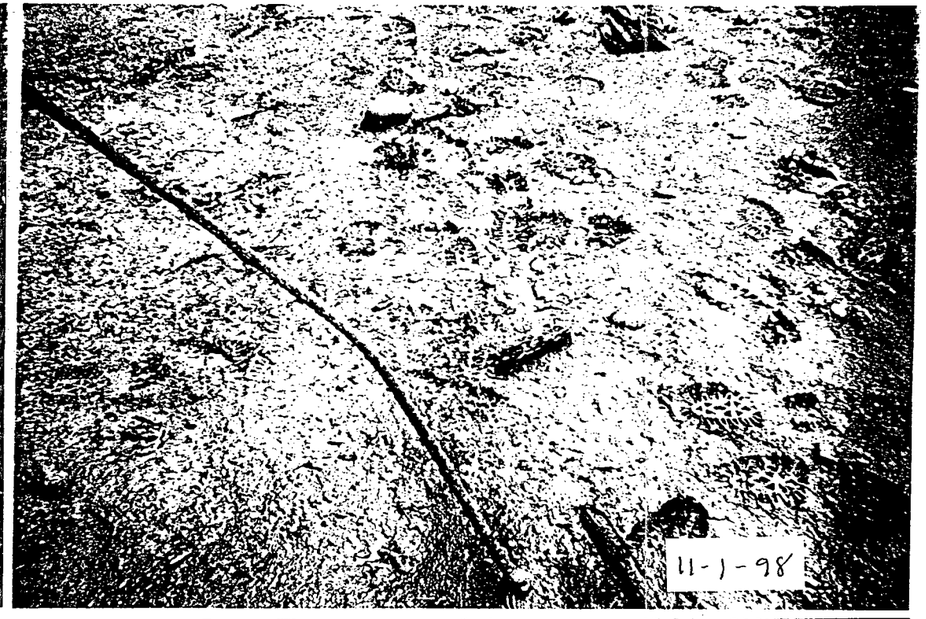

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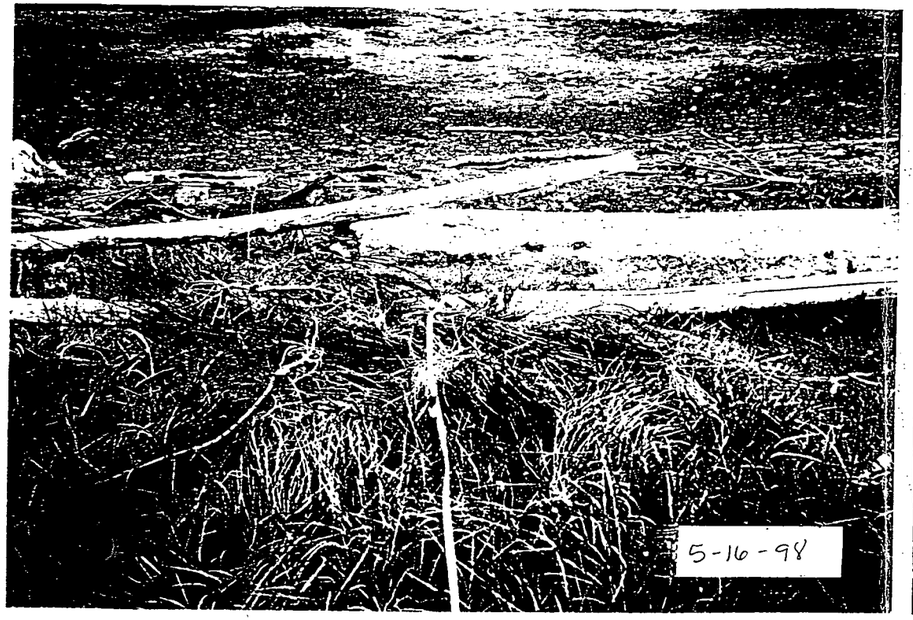

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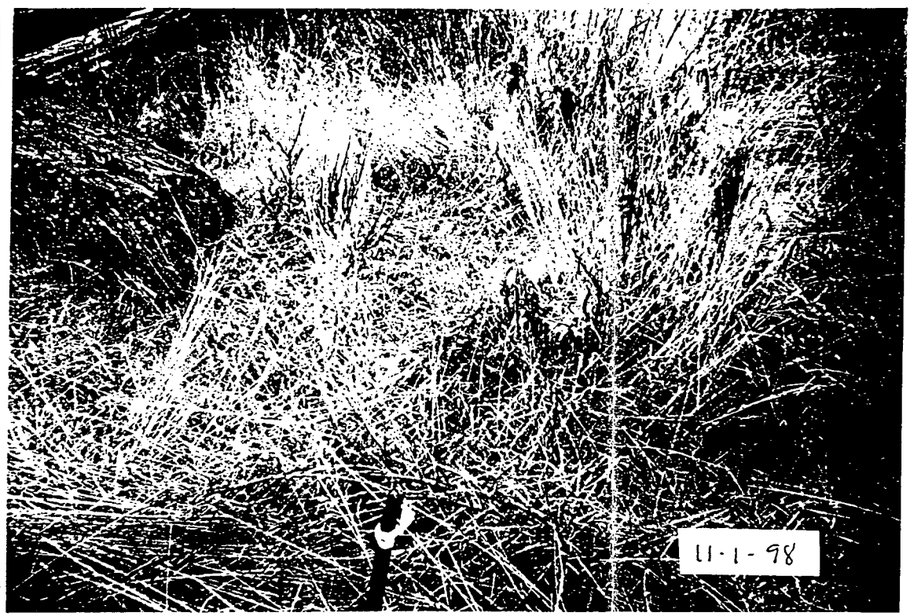

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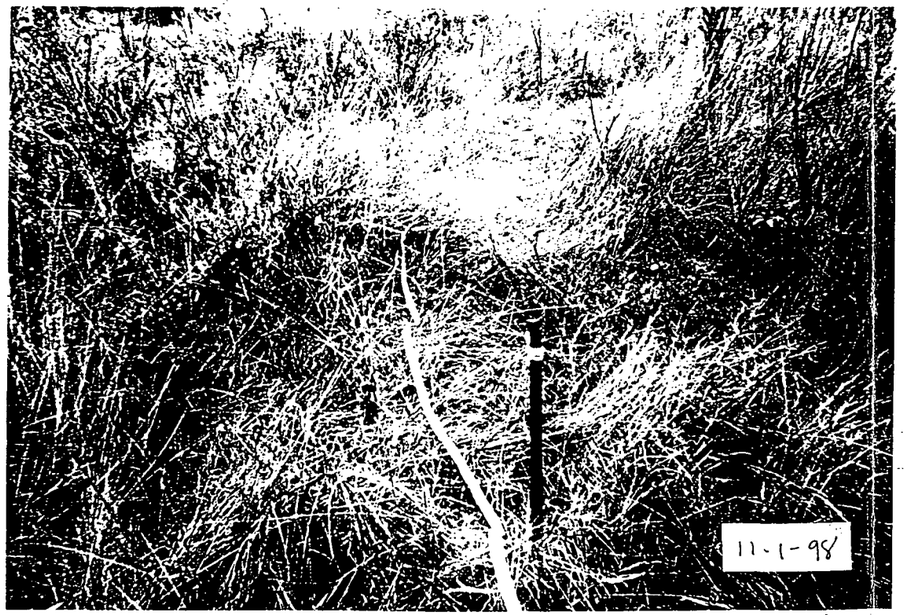

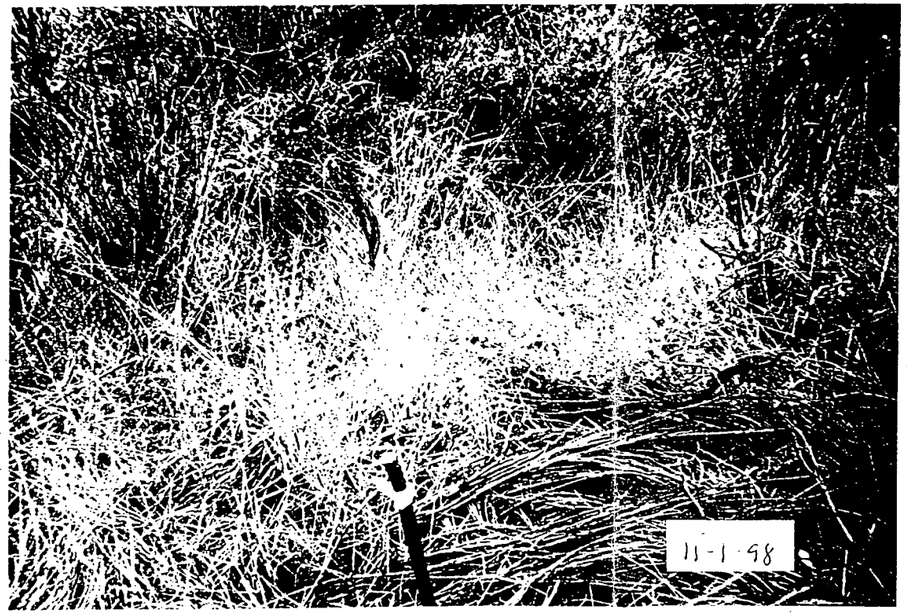

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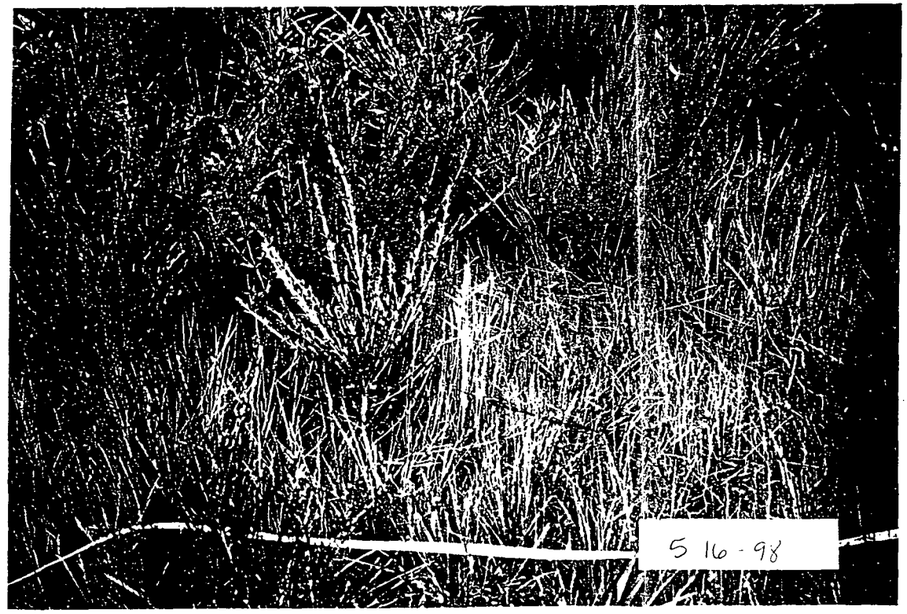

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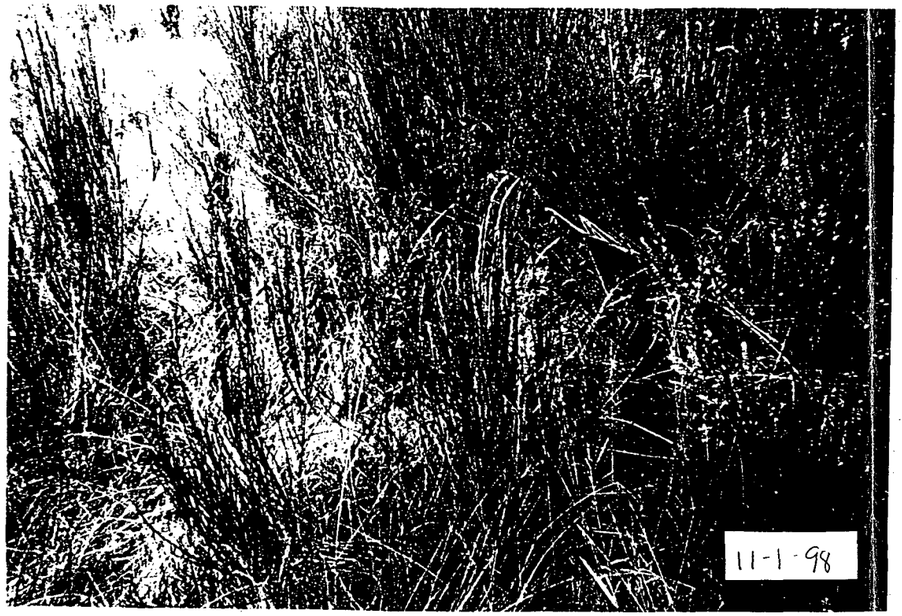

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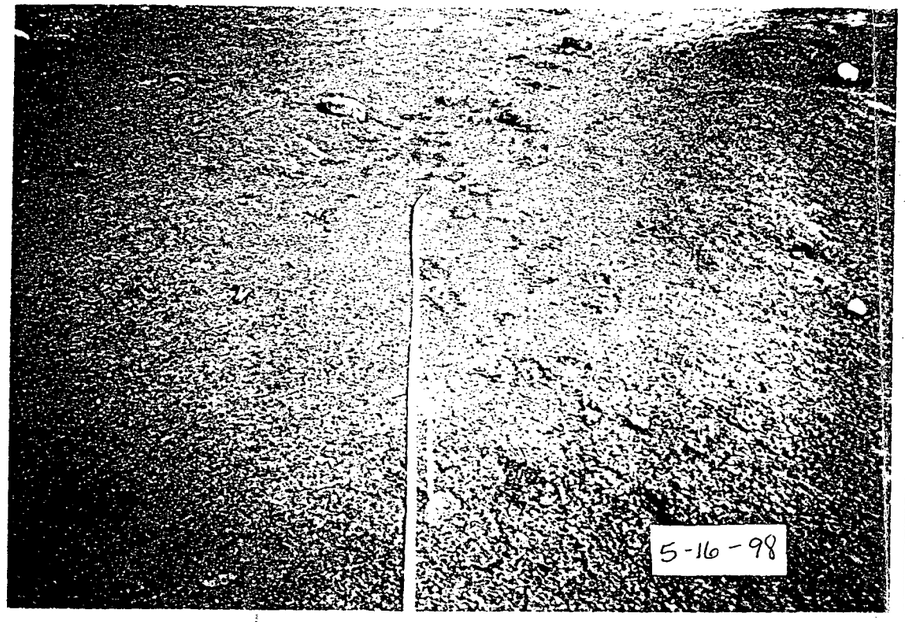

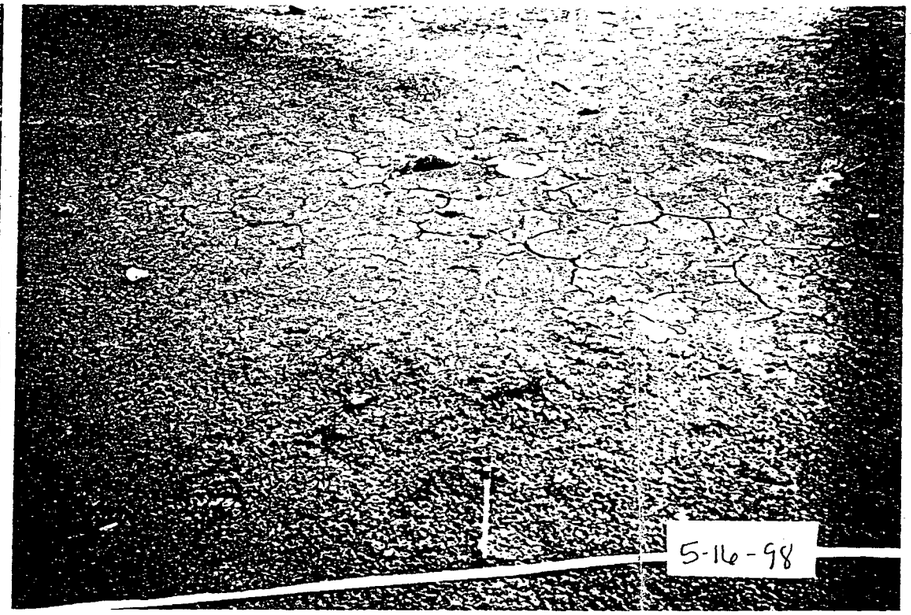

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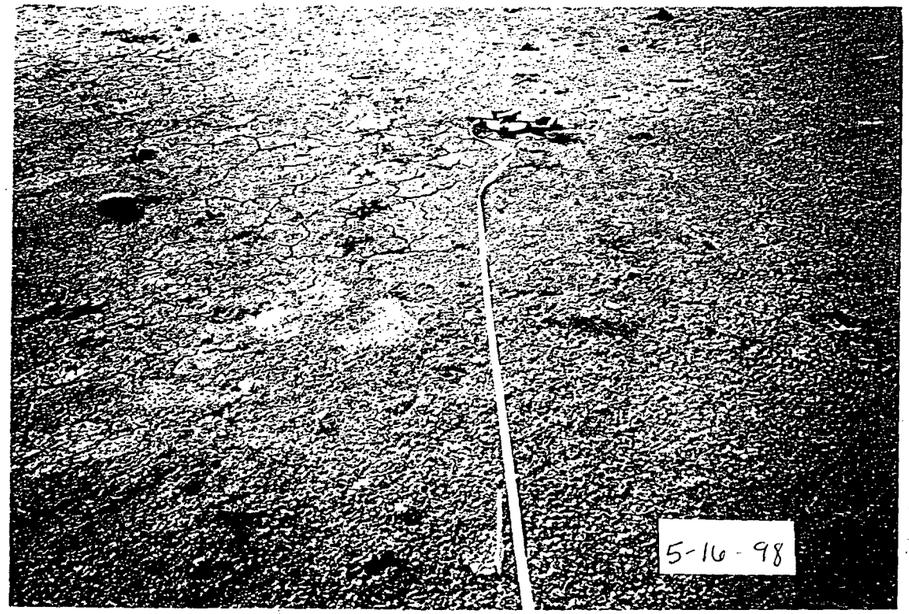

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OUTER HYLEBOS MONITORING STATION 5 - SPRING

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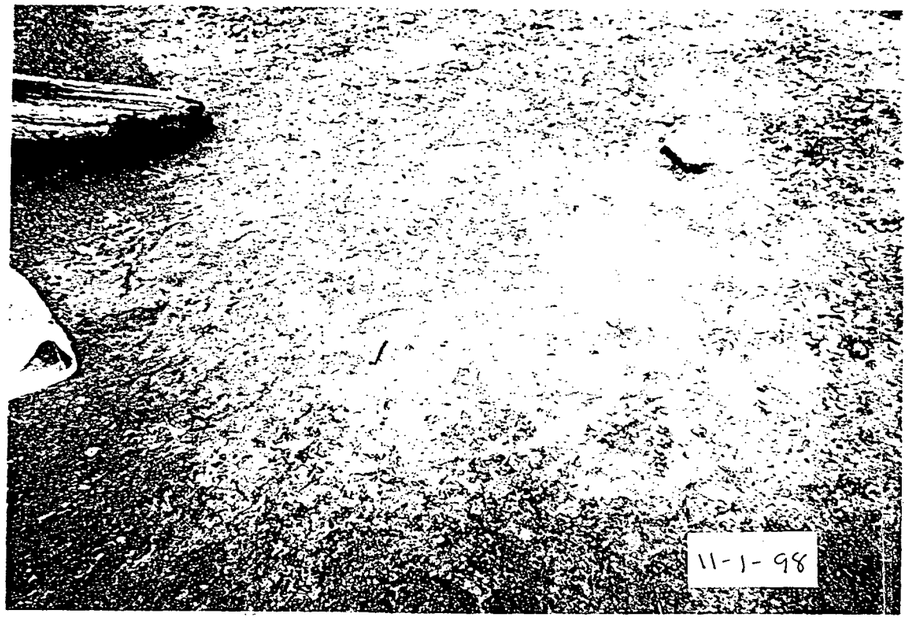

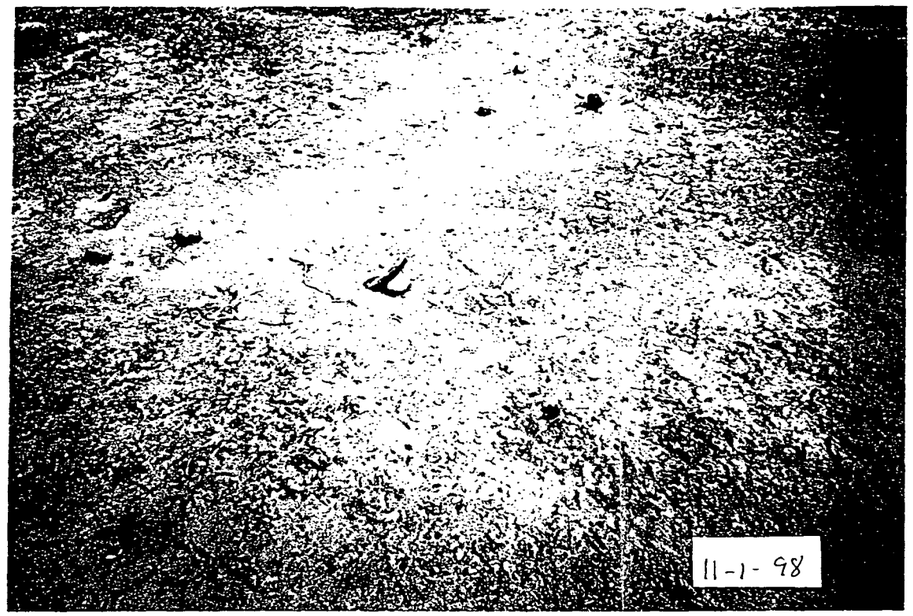

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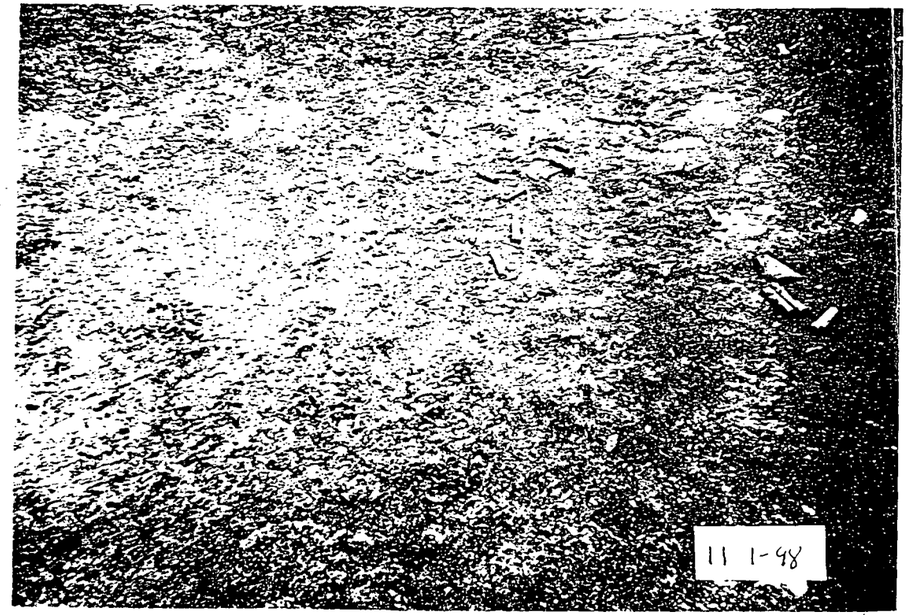

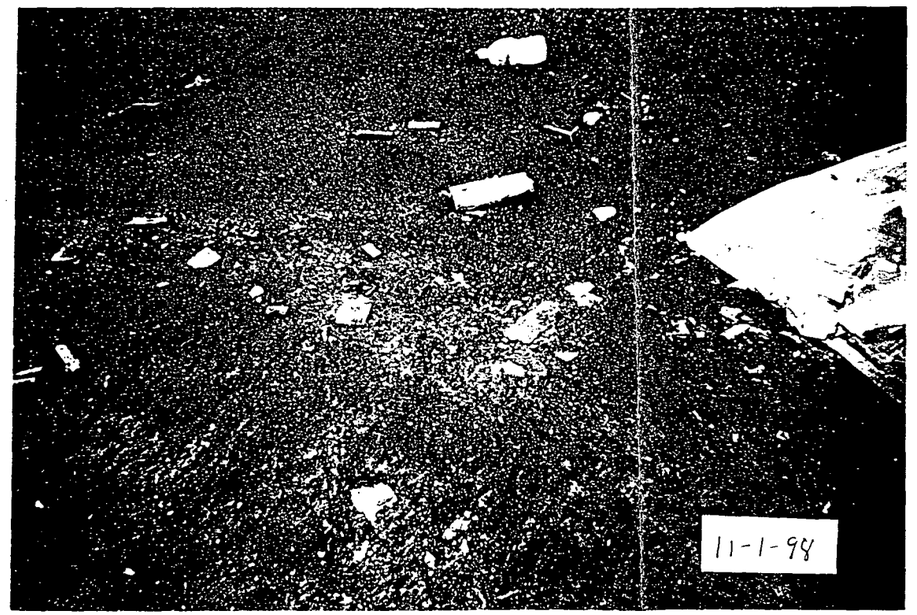

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OUTER HYLEBOS MONITORING STATION 5 - FALL

OUTER HYLEBOS 4th MONITORING REPORT

APPENDIX B
VEGETATION DISTRIBUTION

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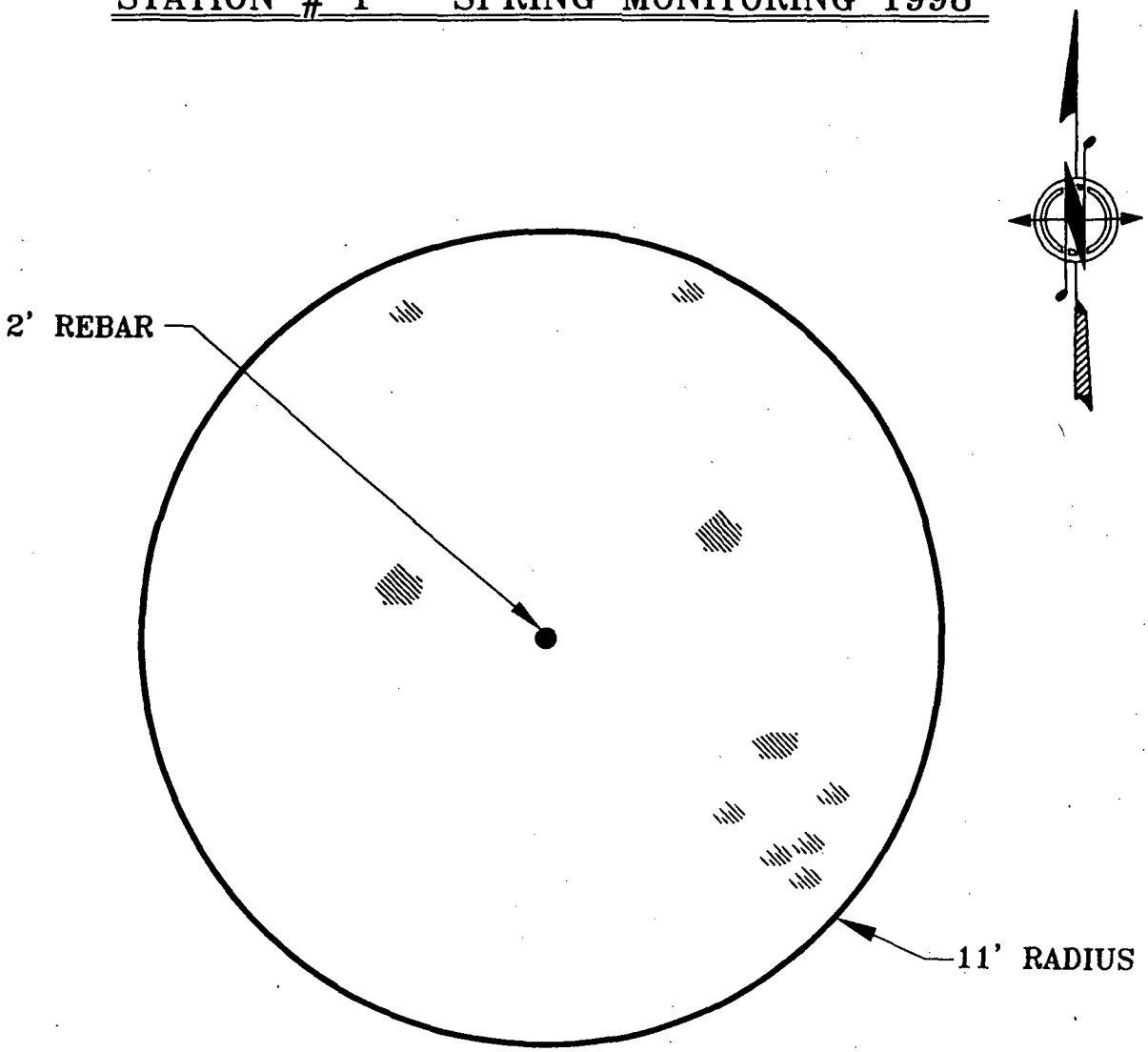
SERVICES,INC.

OUTER HYLEBOS VEGETATION DISTRIBUTION

STATION # 1 – SPRING MONITORING 1998



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ENVIRONMENTAL
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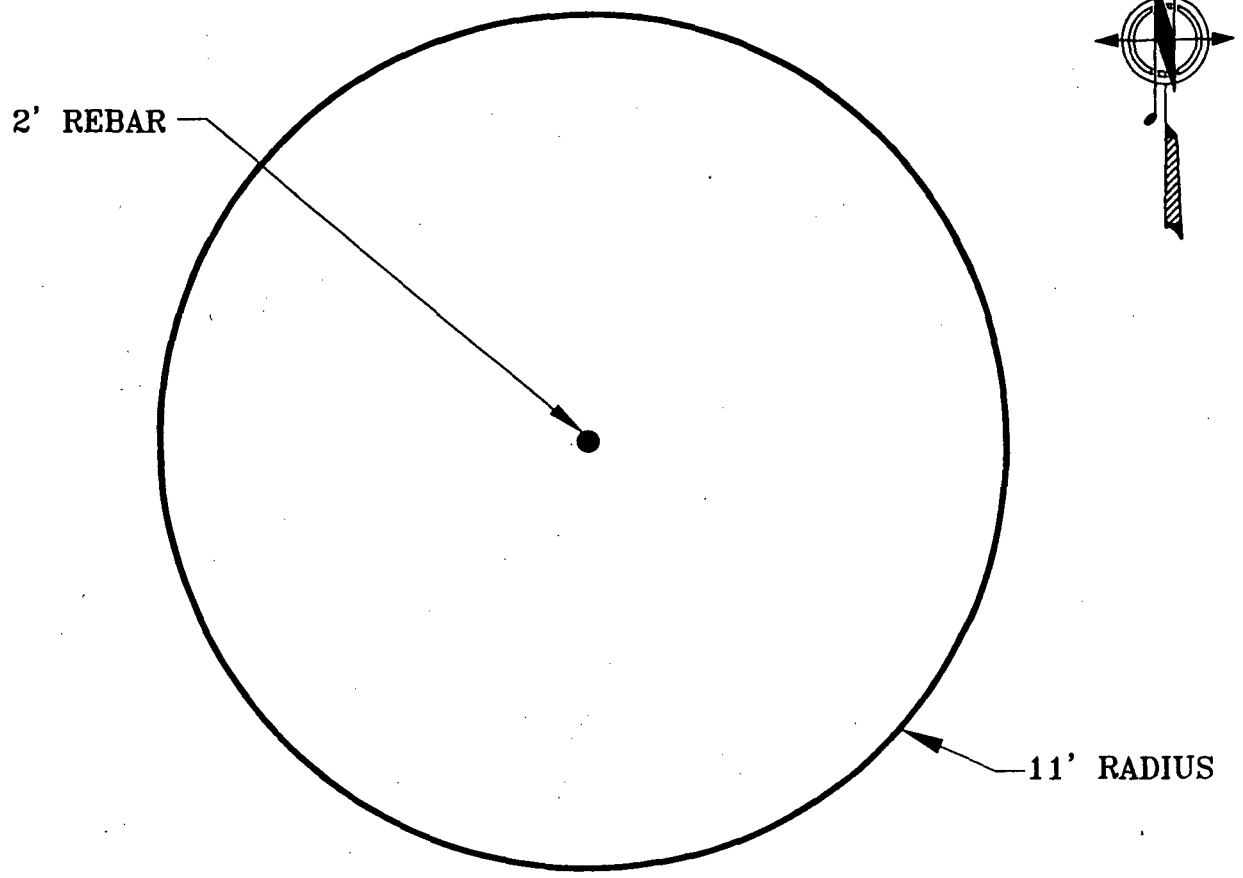
OUTER HYLEBOS VEGETATION DISTRIBUTION

STATION # 1 – FALL MONITORING 1998



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OUTER HYLEBOS VEGETATION DISTRIBUTION

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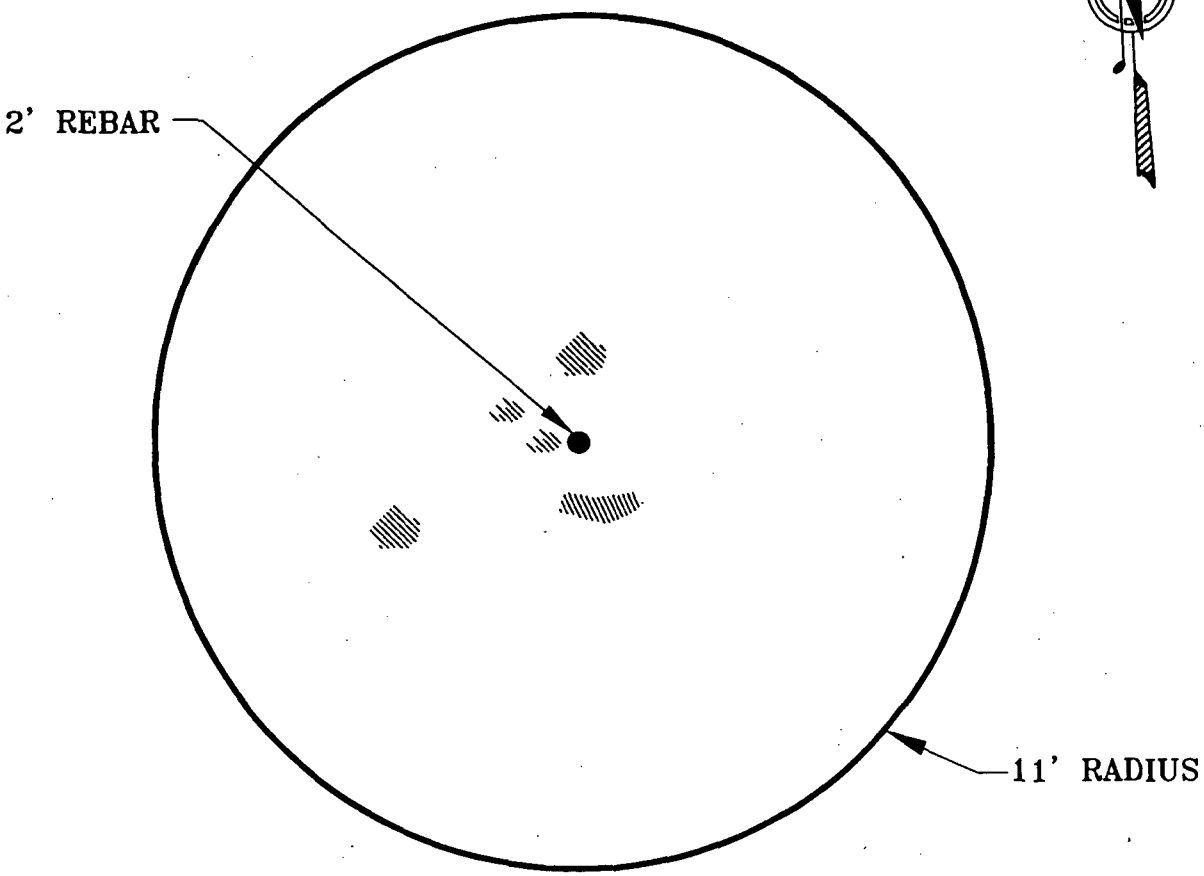

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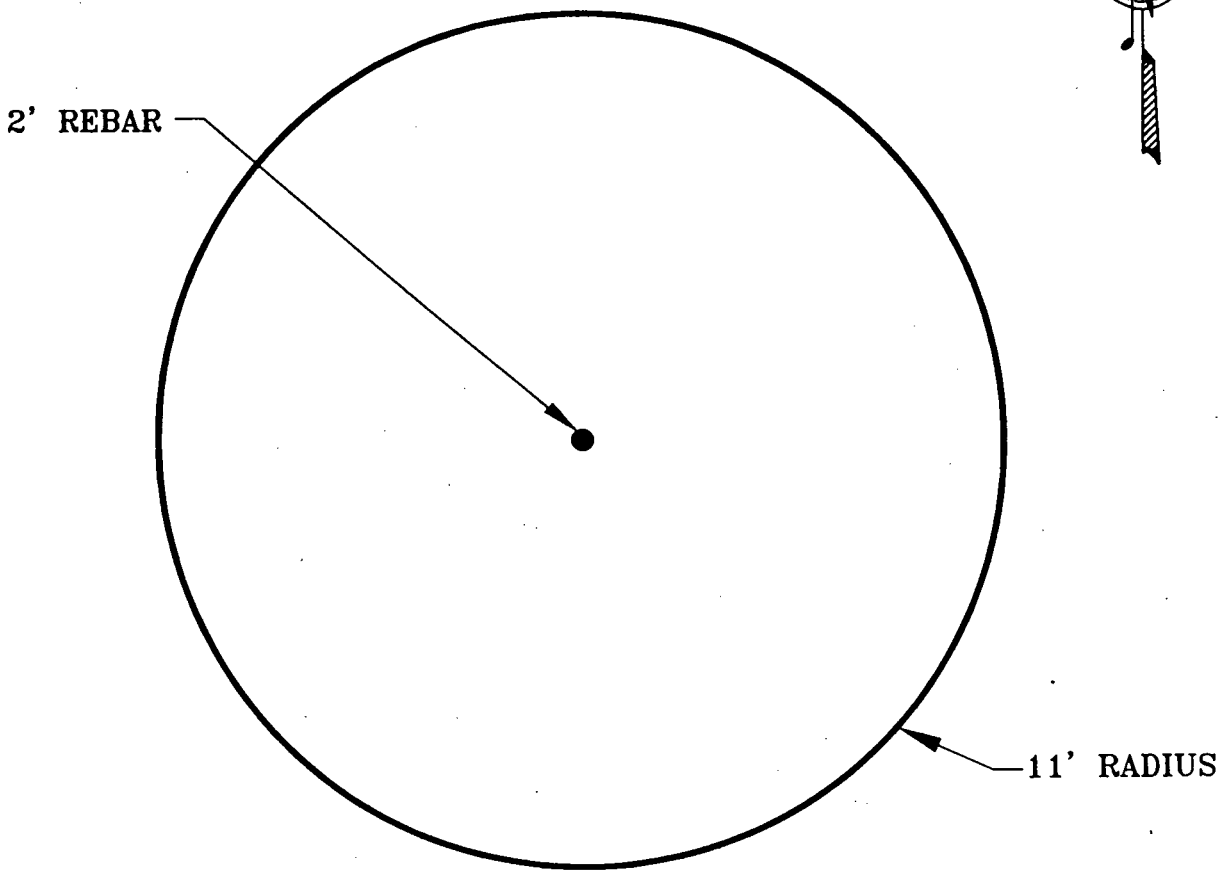
SERVICES,INC.

OUTER HYLEBOS VEGETATION DISTRIBUTION

STATION # 2 – FALL MONITORING 1998



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DATE: 1-11-99

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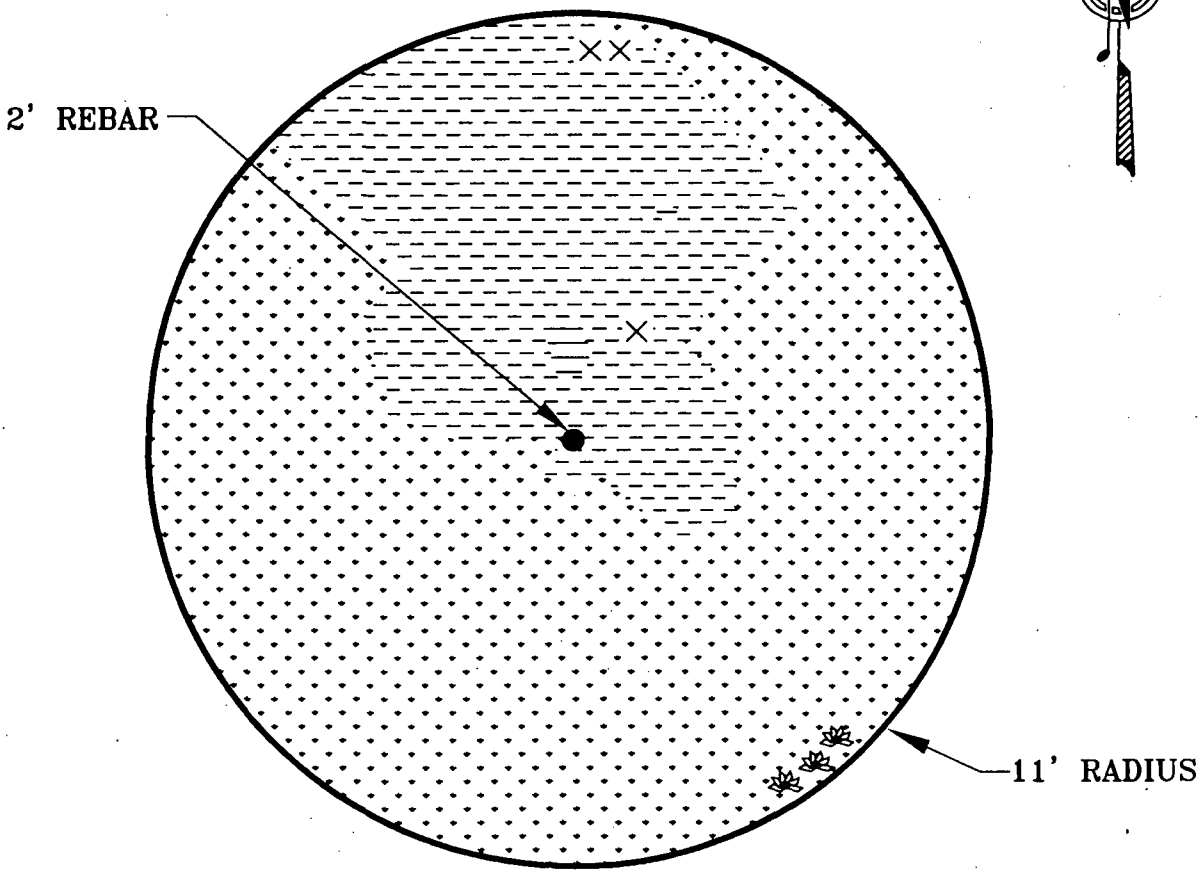
STATION # 3 – SPRING MONITORING 1998



= Scot's broom *(Cytisus scoparius)*

= Douglas aster *(Aster subspicata)*

= Misc. grass *(Gramineae spp.)*

= Common dock *(Rumex occidentalis)*

= Seaside plantain *(Plantago maritima)*

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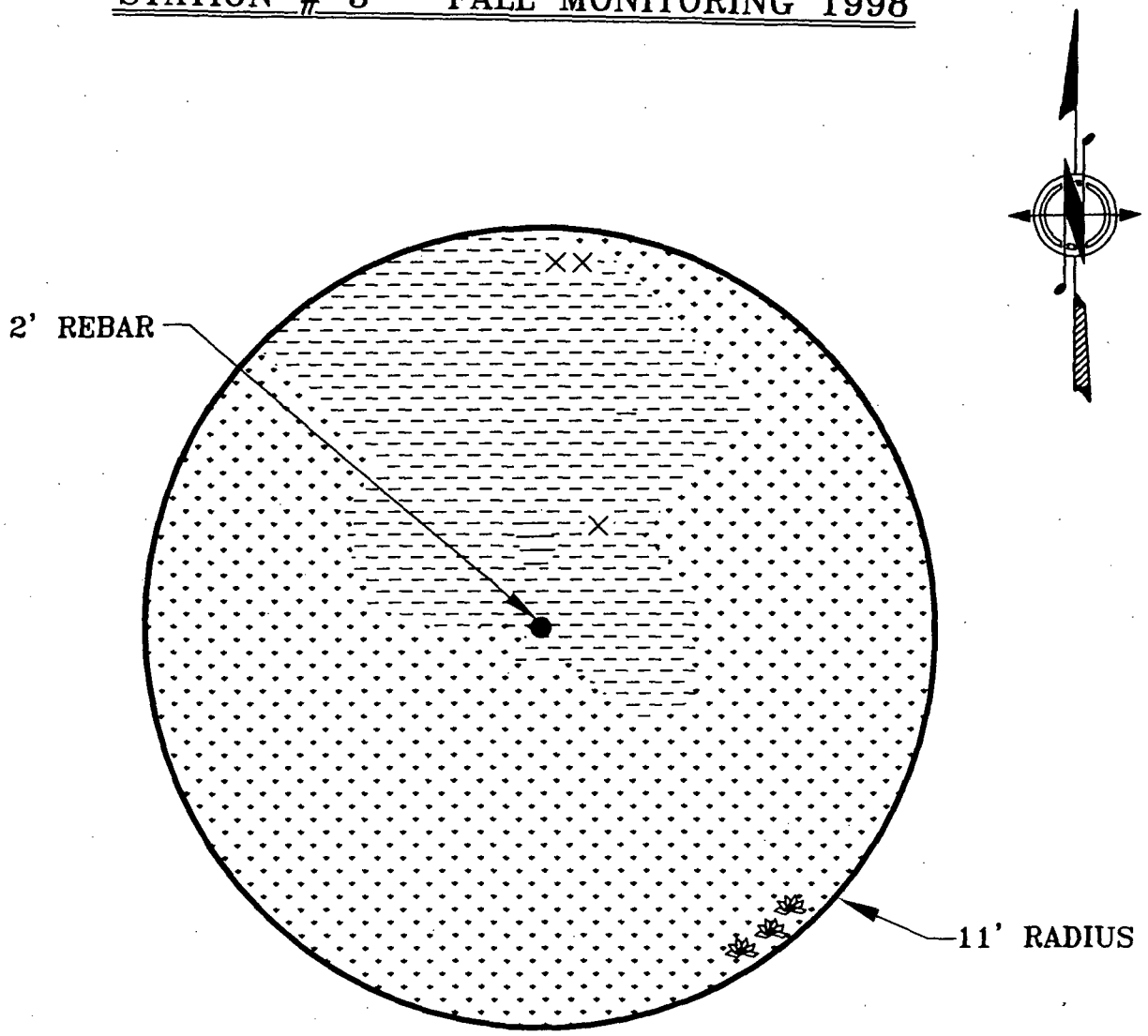
STATION # 3 – FALL MONITORING 1998



= Scot's broom *(Cytisus scoparius)*

= Douglas aster *(Aster subspicata)*

= Misc. grass *(Gramineae spp.)*

XXXXX = Common dock *(Rumex occidentalis)*

= Seaside plantain *(Plantago maritima)*

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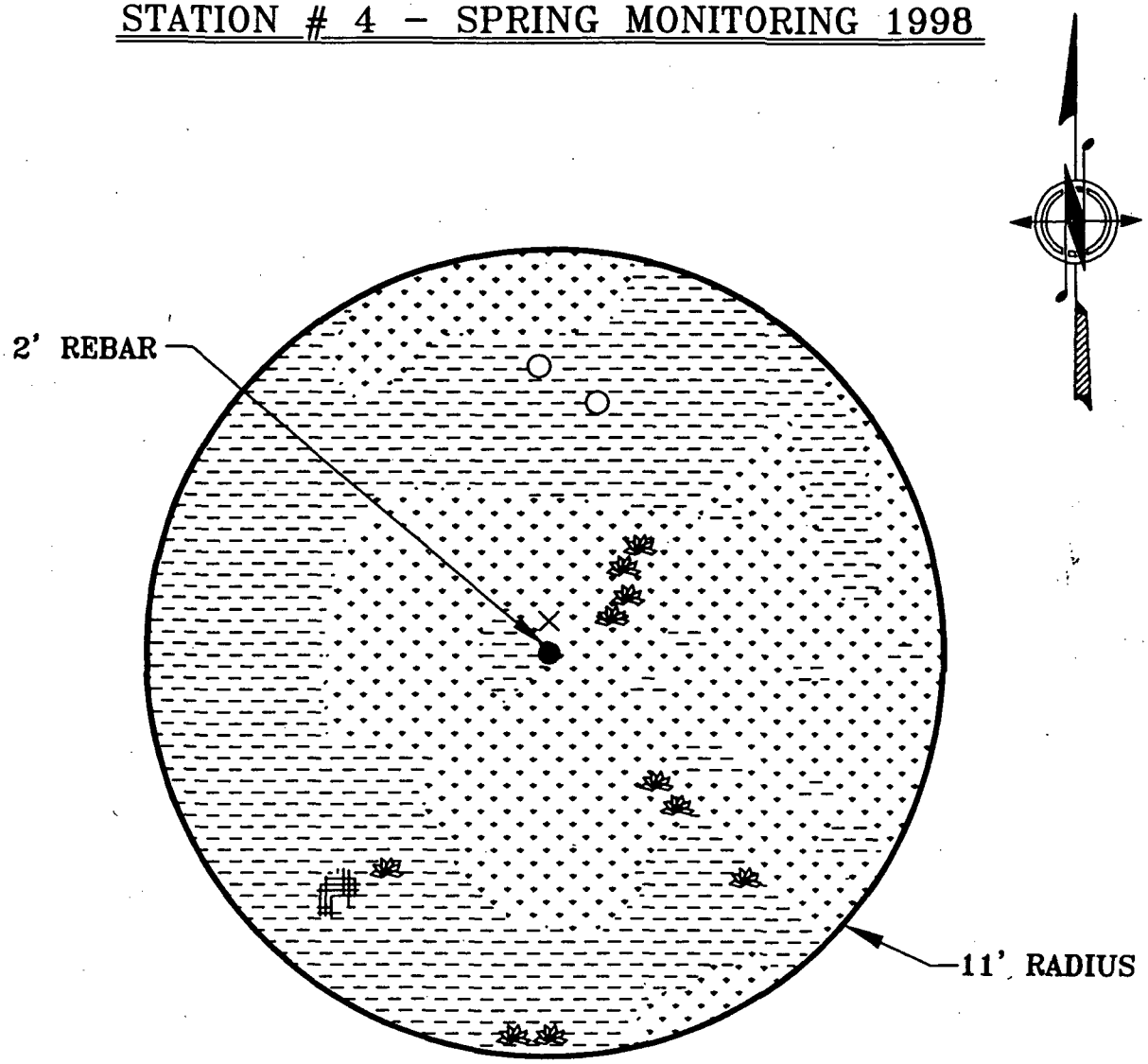
STATION # 4 – SPRING MONITORING 1998



XXXXX = Common dock *(Rumex occidentalis)*

= Scot's broom *(Cytisus scoparius)*

= Dune tansy *(Tanacetum bipinnatum)*

= Misc. grass *(Gramineae spp.)*

O O O = Twinberry *(Lonicera invulucrata)*

= Seaside plantain *(Plantago maritima)*

+ + + + + + = Nootka rose *(Rosa nutkana)*

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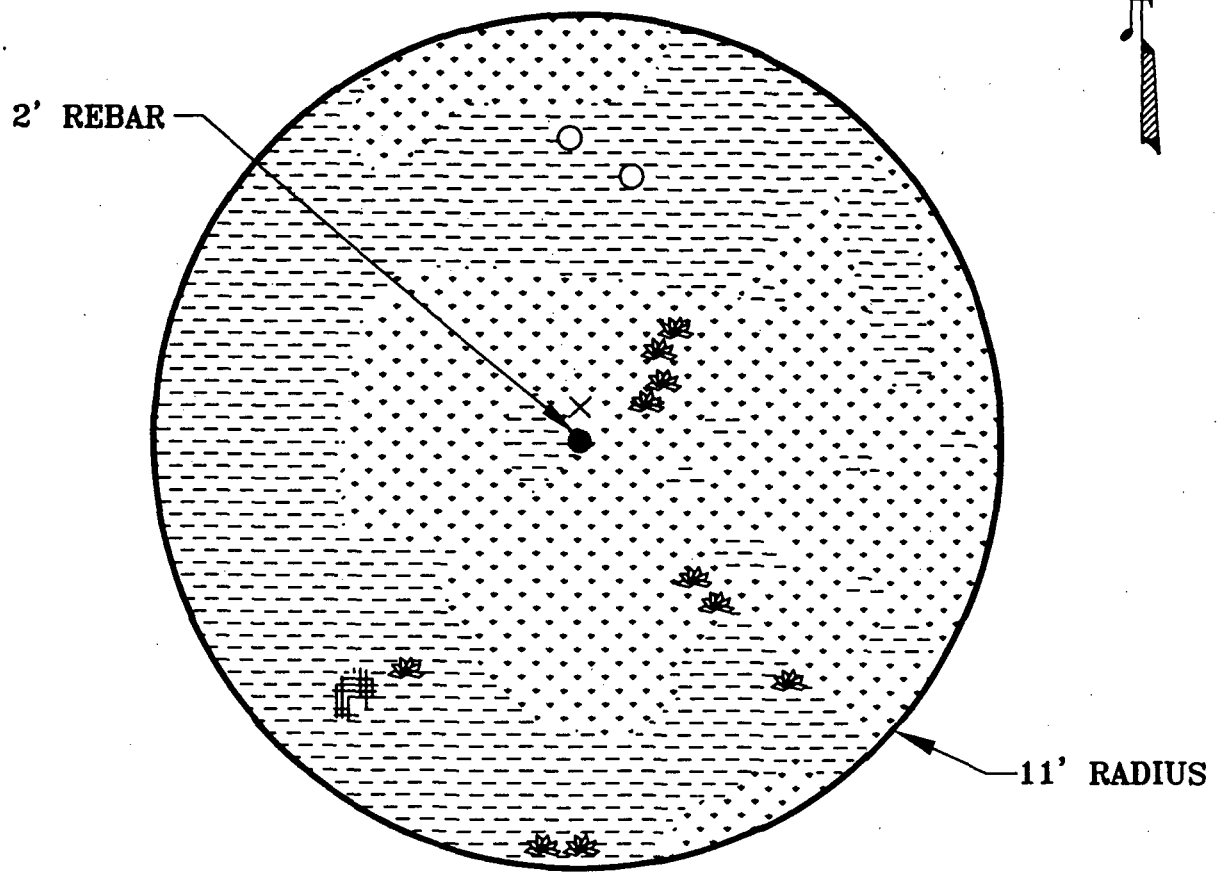
STATION # 4 – FALL MONITORING 1998



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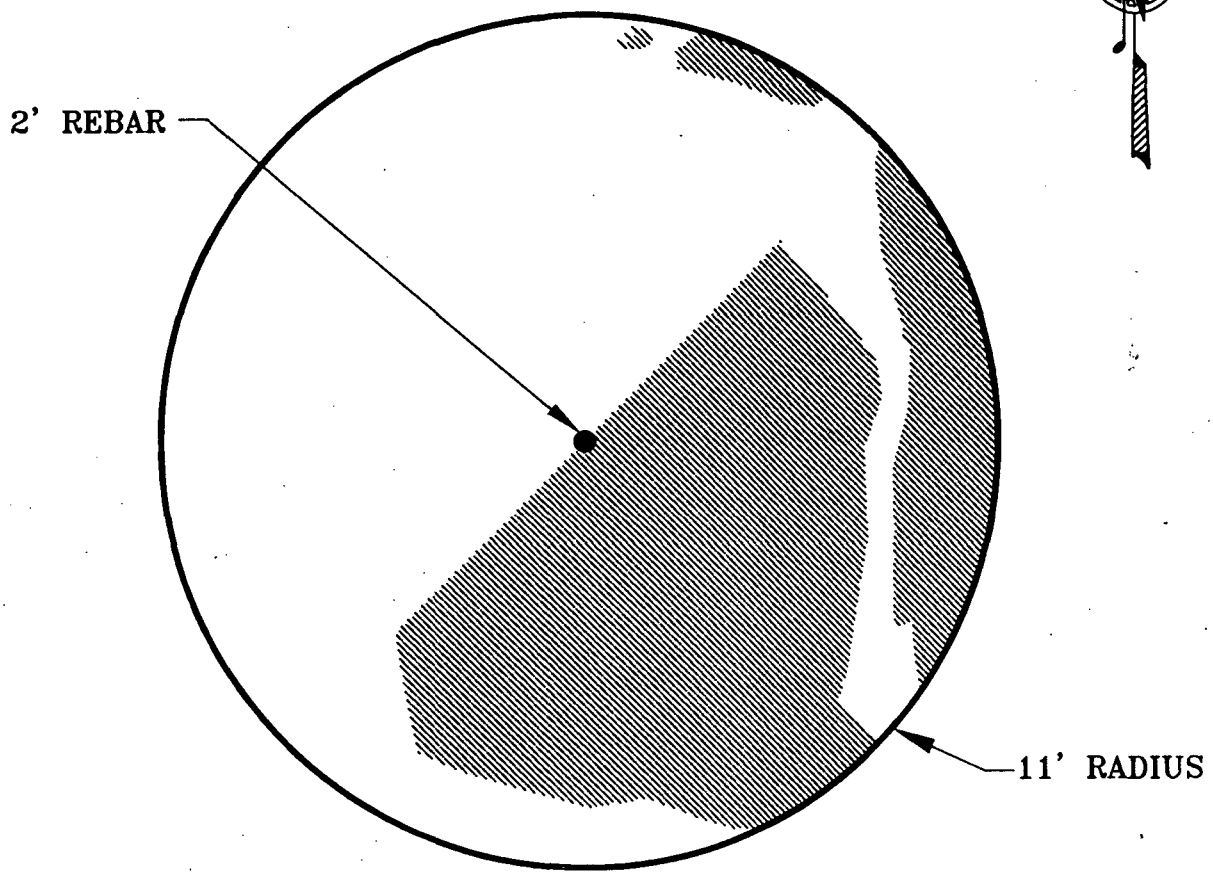
STATION # 5 - SPRING MONITORING 1998



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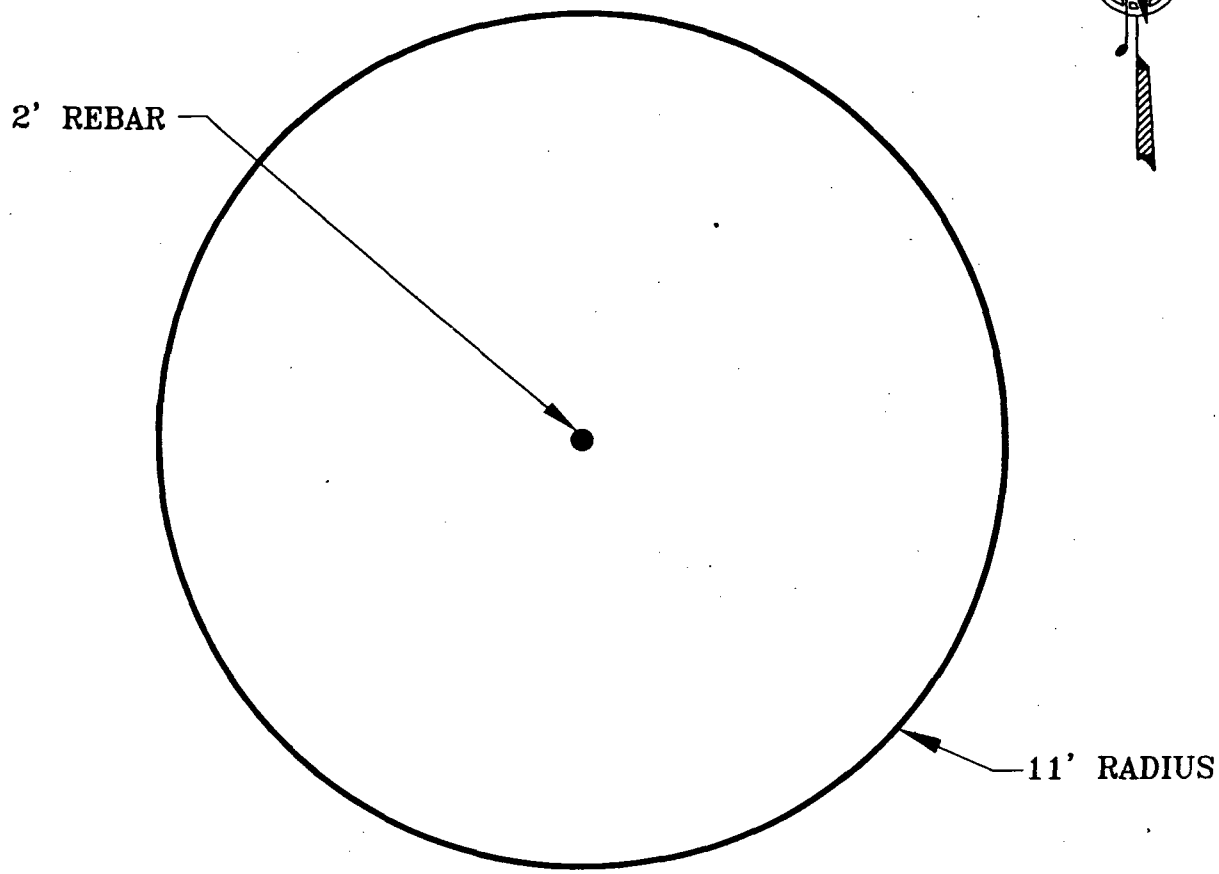
STATION # 5 – FALL MONITORING 1998



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